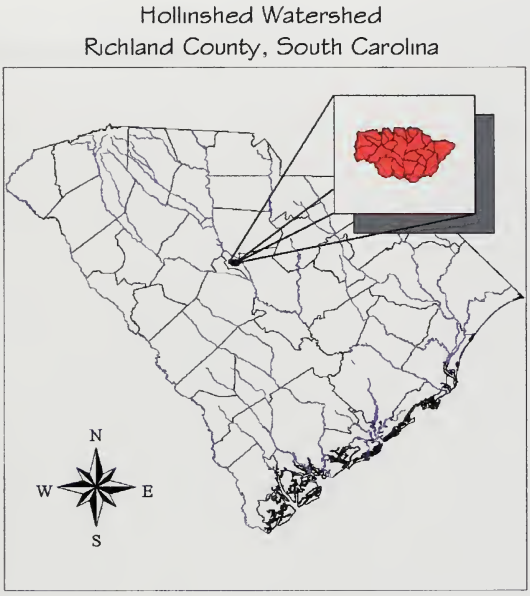
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University of South Carolina, Department of Civil and Environmental Engineering



Analysis of Hollinshed Watershed Using GIS Software

A Research Project Submitted in Fulfillment of Course Requirements for ECIV 797, Special Topics in Civil Engineering

By

Michael Hipp

August 12, 1999

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Introduction/Background

The Hollinshed watershed, located near the western border of Richland County, has seen a large increase in development over the past five years. Planners anticipate increased development in this area because of its easy access to major interstates, yet rural setting. US Highway 76 bounds the watershed on the west side and Kennerly Road to the North. Several small streams converge to Hollinshed Creek to drain the watershed. Hollinshed Creek discharges into the Broad River.

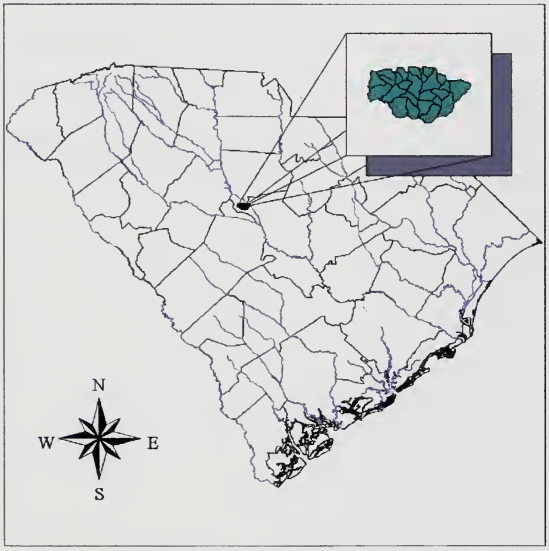


Figure 1 - Hollinshed Watershed Basin Overview Map

The Hollinshed watershed consists of mostly forest in good condition intermixed with single family homes on lots that are typically greater than 1 acre. Because of its rural nature, development in the watershed is likely to have a significant effect on the

surface water runoff within the watershed and especially near the foot of the watershed where several small streams combine.

To date, the typical development in the watershed consists of clearing the natural forest and constructing single family subdivisions on approximately ¼ acre lots. This tight grouping of houses and the accompanying paved roadways, decreases the amount of rainwater than is allowed to soak into the ground, thus increasing the surface water runoff. The effect that this increase in runoff will have on the watershed streams and road crossings is not quantifiable without a detailed study of the watershed. Using the current hydrologic study methods, this type of study is labor intensive and not fiscally possible. To accomplish this task, an automated system is needed. Current Geographic Information System (GIS) software is ideal for this task.

Objectives

The objective of this study is to apply GIS and stormwater modeling software to develop an accurate hydrologic model of the Hollinshed watershed. Use of GIS will allow the user to quickly change the landuse of specific areas within in the watershed to determine the hydrologic effects throughout the watershed using the stormwater model.

Specific objectives were to: 1) develop a GIS database for the Hollinshed watershed; 2) Develop an appropriate link/node diagram and corresponding input file for the stormwater model Drain:Hydro®; 3) Study impact caused by current and future development on the stormwater runoff in the watershed.

Approach

The first step in this project was to develop a GIS database for the Hollinshed watershed. Because not all of the required information is available in a digitized format, this proved to be an arduous task. The baseline of the GIS model, the digital elevation model (DEM), however, was available. The DEM was used to delineate the watershed, construct the stream network, and delineate the subwatersheds. The DEM was combined with soil survey maps and land-use maps to calculate the weighted curve number (CN) and peak rate factor (PRF) for each subwatershed.

Using the subwatersheds and the stream network, the author developed the input file for Drain:Hydro®. The weighted CN and PRF information developed in ArcView® was input into Drain:Hydro® manually. The road crossing information and the pond information is not reflected in the stormwater model due to time limitations, however, all of the road crossings were checked to determine if they would be susceptible to cause storage due to a constriction in flow.

Finally, the landuse of specific areas of the watershed were to determine the impact of future development and to determine the time that would be required if this task were to be necessary on a routine basis.

Data Acquisition and Discussion

To utilize GIS for a complex model such as this one, one must be proficient in the use of ArcView® and ArcInfo®. Without this knowledge, this modeling process almost impossible. For the author, the learning curve associated with the GIS software, was the most time consuming task in this project.

In order to utilize the GIS capabilities effectively and efficiently, all of the data must be in a digital format. To date, all the data except the soil maps for this particular watershed are available in this format. The South Carolina Department of Natural Resources (DNR) has the soil survey information for South Carolina in a digital format for approximately 50% of the state. When this information is readily available, the time required for this task will be greatly reduced. Also, the DNR is developing updated landuse maps that will be available in spring 2000. This will improve the accuracy of current hydrologic models and further ease the GIS process. Since the soil maps were not available in a digital format, they were digitized from the "Soil Survey of Richland County, South Carolina" (SCS, 1978). The soil survey maps were digitized using AutoCAD® and exported into the GIS software (ArcView 3.1®) as a drawing exchange file (DXF).

The DEM files were obtained from the DNR web site (http://www.dnr.state.sc.us/gisdata/index.html). The land use maps were obtained from the GIS web site maintained by the College of Liberal Arts at the University of South Carolina (http://www.cla.sc.edu/gis/). "The land-use maps were developed from 8 bit .gis files processed in ERDAS from 1989 SPOT imagery" (Shirley, 1999). The images were separated into eight classes: 1) Urban/Built-Up; 2) Agriculture/Grassland; 3)

Rangeland/Fallow; 4) Forest; 5) Water; 6) Forested Wetlands; 7) Non-Forested Wetlands; 8) Barren/Disturbed. The South Carolina Department of Natural Resources originally compiled this data. It was then given to the University of South Carolina for use. Originally, the author attempted to use scanned thermal image photographs imported into ArcView using a Tagged Image File Format (TIFF). Even though this data was more recent (1994), this technique was abandoned because the thermal images were not appropriate for land use determinations, and because of the memory intensive files that were created. Since the SPOT image maps were developed in 1989, they were used to represent the historical landuse condition. Modifying the original map based on field surveys conducted by the author, resulted in a present land use map. Finally, a future landuse map was developed. Jim Barker of Richland County Public Works Department provided a listing of approved projects in the Hollinshed watershed. Using this data, in combination with likely areas of development identified in the field surveys, the projected land used map was finalized.

The road crossing data was gathered by a field survey conducted by Rocky Archer and Michael Hipp. This data is tabulated in Appendix 1. Stage-Storage relationships for the ponds in the watershed were not determined due to time limitations.

Results

Using the DEM files, one is able to delineate a specific watershed and subwatersheds based on the direction of waterflow in each grid. The grid size is 30 m x 30 m. A subwatershed is delineated when a junction has 1000 or more grids that contribute water to it. The resulting watershed is illustrated in Fig. 2.

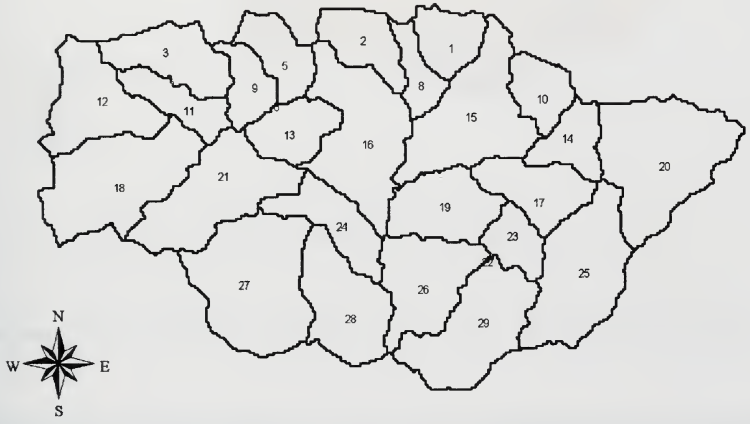


Figure 2 – Hollinshed Subwatersheds, Richland County, South Carolina

Next, the digitized soil map was converted to an ArcView 3.1 shape file using ArcInfo. The resulting soils map is illustrated in Figure 3.

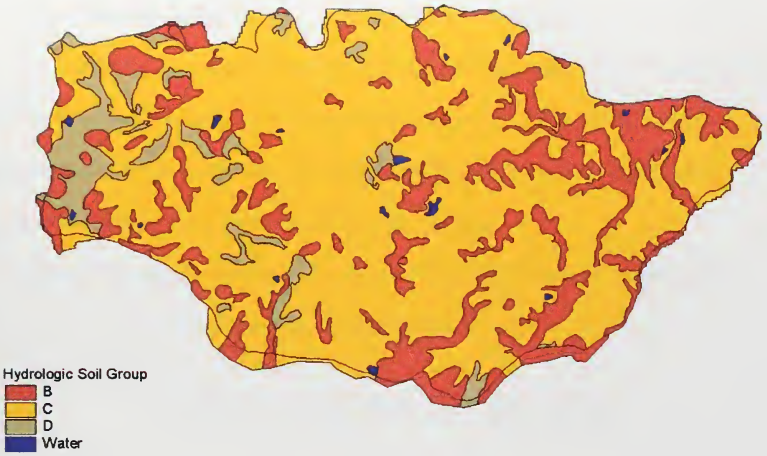


Figure 3 – Hydrologic Soil Groups

There are a total of 10 different soil types in the watershed. They are described in Table 1.

Name	Initial	HSG
Geogeville	GeB & GeC	B
Herndon	HeB	B
Altavista	AtA	C
Chewacla	Ce	C
Kirksey	KrB	C
Nason	NaB, NaC, & NaE	C
Orange	Oab	D

Table 1 – Soil Types (SCS, 1978)

The majority of the soils in the watershed were hydrologic soil Group C. "Group C soils have a slow infiltration rate when thoroughly wet. These soils consist chiefly o soils that have a layer that impedes the downward movement of water…" (SCS, 1978). These properties indicate that the watershed will have a relatively high level of runoff during a storm event, because the water will not infiltrate into the soil.

Finally, the landuse maps were developed as discussed previously. The resulting past, present, and future landuse conditions are displayed below.

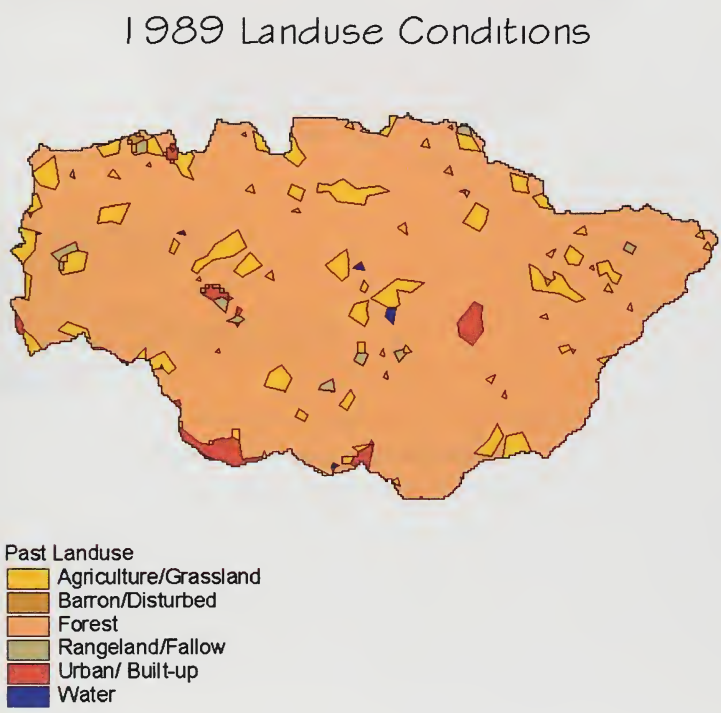


Figure 4 – Past Landuse Conditions

Present Landuse Conditions



Figure 5 – Present Landuse Conditions

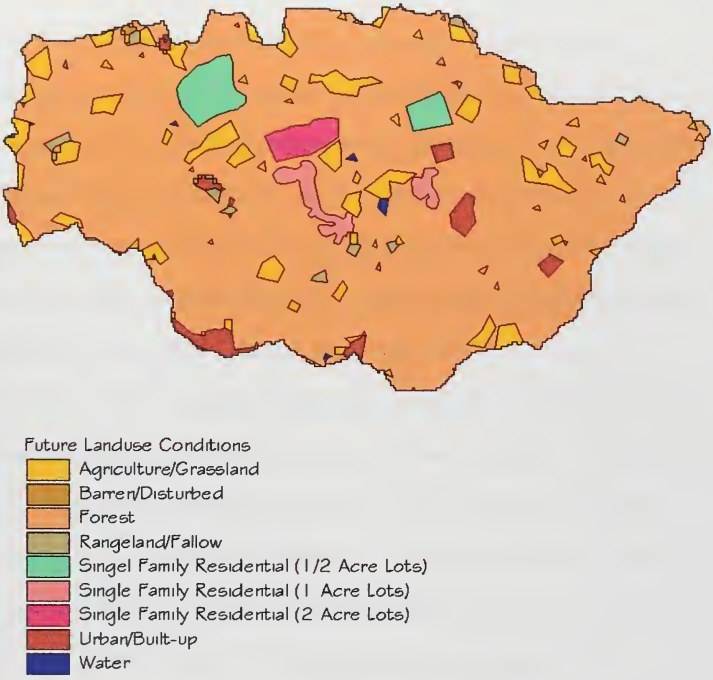


Figure 6 – Future Landuse Conditions

Culmination

The subwatersheds, soil types, and landuse themes were overlaid in ArcView to determine the area of each landuse/soil type combination in each subwatershed. This was accomplished by using the Geoprocessing Wizard extension in ArcView 3.1 in combination with an Avenue (ArcView programming language) script written by Xingong Li to calculate the individual polygon areas. With these areas, a weighted Curve Number (CN) and weighted Peak Rate Factor (PRF) were determined for each subwatershed. The Curve Numbers were assigned using SCS's TR-55 (SCS, 1986) as guidance. The Peak Rate Factors were assigned based on landuse in accordance with values distributed by Dr. Michael Meadows (Meadows, 1993).

These CNs and PRFs were input into Drain:Hydro® with the subwatershed area, average subwatershed slope, and the hydraulic length of each watershed. The area, slope, and hydraulic length were all calculated in ArcView, using the Hydro 2.4 extension. Next, the stream data was input into Drain:Hydro ®. Drain:Hydro® was then used to model the watershed for the past, present, and future scenarios using a 25, 50, and 100 year rainfall event for each scenario. The rainfall data is summarized in Table 2.

Rainfall Event Frequency (24 hr)	Amount of Precipitation (inches)
25 year	6.35
50 year	6.9
100 year	7.5

Table 2 – Rainfall Intensity in Richland County (Purvis, et. al., 1988)

Because of time limitations, the road crossing data was not included in the Drain:Hydro® input file. The road crossings were, however, analyzed to determine whether they were likely to significantly impact the stormwater model. This analysis was done by computing the rating curve for each crossing and the rating curve of the stream immediately upstream of each crossing. The rating curves of the road crossing structures were computing using CulvertMaster®, version 1.0. The rating curves of the streams were computed using FlowMaster®, version 5.15. The model will be affected if the road crossing structure impedes the flow of the natural channel. Based on the results of the analysis, the road crossings will have significant effects on the model and should be considered in future models. The rating curves for each crossing are attached as Appendix 2. The corresponding node numbers on the link node diagram, Appendix 3, identify the location of the structure.

Drain:Hydro® Results

The stormwater runoff at the outfall of the watershed is summarized in Table 3.

Stormwater Runoff Summary			
Peak Flow at Outfall in cfs			
	Rainfall Frequency (yrs)		
Landuse Scenario	25	50	100
Past	4069	5036	5847
Present	4135	5113	5935
Future	4183	5168	5999

Table 3 – Stormwater Runoff Summary

The change in landuse from the historical use of the watershed to its present use created an increase of stormwater runoff of approximately two percent. Based on the projected changes in landuse in the future, the runoff will increase an additional one percent.

As illustrated in Figure 7, the changes in the watershed from 1989 to present have a significant impact on subwatershed 16. The stormwater runoff at this outfall increased from 2271 cfs to 2312 cfs, a 2 % change, for a 25 year storm event.

Projected changes significantly impact subwatershed 9. These changes increase the outfall from this subwatershed from 634 cfs to 650 cfs, a 3% change. These changes are illustrated in Figure 8.

The changes in runoff from subwatershed that were significantly changed by development are detailed in Table 4. The runoff for all watersheds are detailed in the Drain:Hydro® output in Appendix 4.

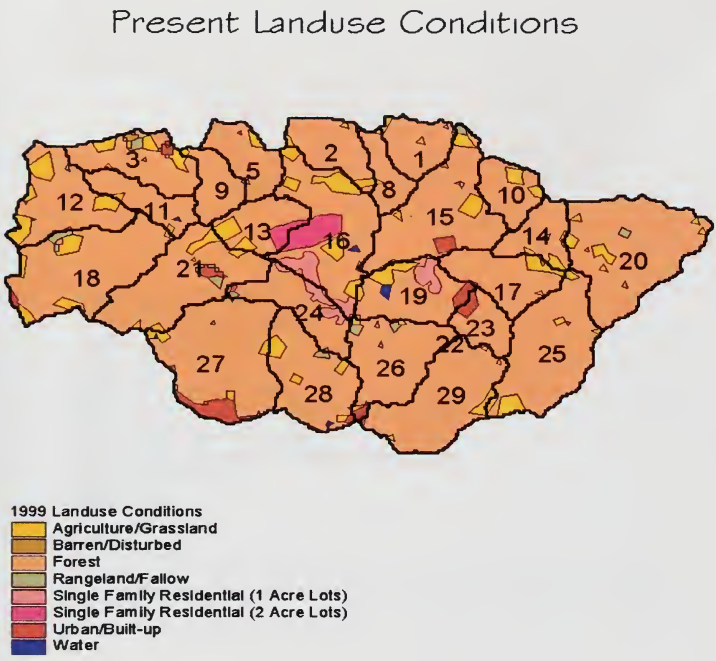


Figure 7 – Present Landuse Condition with Subwatershed Overlay

Future Landuse Conditions

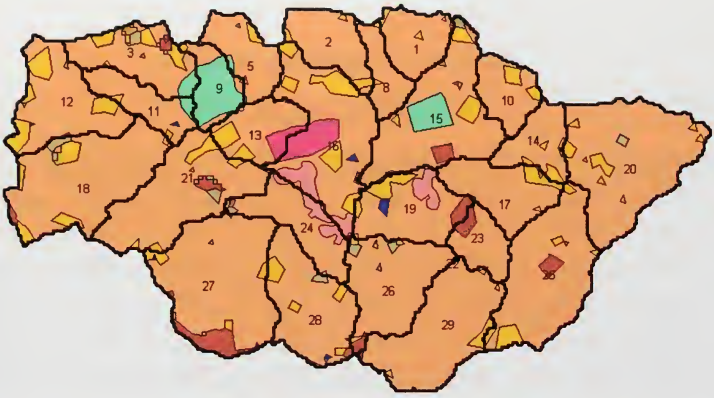


Figure 8 – Future Land Use Conditions with Subwatershed Overlay

Stormwater Runoff Summary

Peak Runoff (cfs)									
	1989 Landuse			1999 Landuse			Projected Landuse		
WS #	25 yr	50 yr	100 yr	25 yr	50 yr	100 yr	25 yr	50 yr	100 yr
9	634	779	901	634	779	901	650	798	922
13	2082	2559	2957	2122	2606	3010	2152	2642	3052
15	2575	3172	3673	2616	3221	3728	2650	3262	3773
16	2271	2792	3227	2312	2840	3281	2344	2877	3325
Outfall	4069	5036	5847	4135	5113	5935	4183	5168	5999

Percent Increase in Runoff						
	1989 - Present			Present - Future		
WS #	25	50	100	25	50	100
9	0%	0%	0%	3%	2%	2%
13	2%	2%	2%	1%	1%	1%
15	2%	2%	1%	1%	1%	1%
16	2%	2%	2%	1%	1%	1%
Outfall	2%	2%	2%	1%	1%	1%

Table 4 – Stormwater Runoff Summary

Conclusion

The Hollinshed watershed has a strong potential for development. Given its rural nature, this development could significantly impact the stormwater runoff in the watershed as demonstrated by the results of this study. The use of GIS software allows the user to quickly calculate the impact of these changes, and provides an unlimited method of presenting this data. Though the use of GIS software requires significant computer resources and training, the results of this short study clearly demonstrate the capability of programs such as ArcView® in the development of a hydrologic model.

Though this model includes only the basic parameters, it provides a base point for future models in this watershed and a demonstration of the potential of GIS software in the field of Civil Engineering.

References

ArcView GIS Version 3.1, Copyright©1992-1998, Environmental Systems Research Institute, Inc.

Li, X. (1999), "Polyarea", Avenue Script, University of South Carolina, Columbia, SC.

Meadows, M. E. and E. W. Ramsey (1991), "South Carolina Regional Synthetic Unit Hydrograph Study: Methodology and Results", Project Completion Report, Vol. II, U. S. Geological Survey, Columbia, S.C.

Meadows, M. E. (1993) "ECIV 562, Engineering Hydrology – Class Notes", University of South Carolina, Columbia, SC.

Meadows, M. E. (1996) "Drain:Hydro", Version 1.0, University of South Carolina, Columbia, S.C.

Purvis, J. C., W. Tyler, S. Sidlow (1988), "Maximum Rainfall Intensity in South Carolina By County", Climate Report No. G32, South Carolina State Climatology Office, Columbia, S. C.

Shirley, L., (1999), "Geographic Information Science", http://www.cla.sc.edu/gis/index.html, College of Liberal Arts, University of South Carolina, Columbia, SC.

Soil Conservation Service (1978), "Soil Survey of Richland County, South Carolina", United States Department of Agriculture.

Soil Conservation Service (1986), "Urban Hydrology for Small Watersheds", Technical Release 55, Washington, D.C.

Hollinshed Creek Watershed Field Data

Collected on June 21, 1999 by Rocky Archer and Michael Hipp

Final Road Xing Node #	Preliminary Road Xing Node #	Name of Road	Stream Name	Description of Structure	Length (ft)	S_o	Average Ditch Width (ft)	Side Slope z:1
001/2	404	US 176 (Broad River Rd)	Upper Boyd Branch between Hopewell and Shady Brook	Double concrete box culvert 10 ft x 10 ft each with wing walls	50	0.0120	12	5
005/6	407	West Shady Grove	Boyd Branch	9 ft CMP[2] w/ Riprap outfall and concrete lined bottom	58	0.0017	15	3
008/9		Hollinshed Creek Rd.	Hollinshed Creek	24 ft wide arch; 15 ft tall	40	0.0018	20	0.5
010/11	408	Shady Grove Road	Hollinshed Creek	10 ft x 20 ft Bridge opening			20	3
014/15	413	Eleazor Road	Hollinshed Branch (H)[3]	2 x 30 in - RCP	48	0.0021	5	1
017/18	414	Old Brickyard Road	Hollinshed Creek	Bridge (#407093900100) (Scour due to piers)				
019/20	415	Old Tamah Road	Hollinshed Creek	Bridge				
023/24	416	Kennerly Road	Hollinshed Creek	Bridge				
072/73	401	Julius Richardson	Wildhorse Branch	72 in - RCP[1]	54	0.0093	12	2

Final Road Xing Node #	Preliminary Road Xing Node #	Name of Road	Stream Name	Description of Structure	Length (ft)	S_o	Average Ditch Width (ft)	Side Slope z:1
074/75	403	US 176 (Broad River Rd)	Wildhorse Branch	10 ft x 10 ft concrete box culvert	76	0.0013	10	3
077/78		I-26	Metz Branch					
079/80	420	US 176 (Broad River Rd)	Metz Branch	Double concrete box culvert 9 ft x 9 ft	56	0.0018	6	2
081/82		Wise Rd (S-2398)	Metz Branch	36 in - RCP	54	0.0018	6	2
085/86		I-26	Wildhorse Branch					
102/103	409	Shady Grove Road	From pond	36 in RCP	42	0.0155	0	1
130/140	406	Hopewell Church Road	upper Boyd Branch (North of 405)	36 in RCP and 30 in RCP, 6 ft on center (30 in pipe blocked at downstream end by overgrowth)	54	0.0185	6	3
212/213		Staffwood Dr.	Branch of Hope Creek	9 ft x 9 ft Box culvert, (outlet of spillway of small pond; drop inlet 6 ft above water level)	30	0.0018	5	2
218/219	418	Koon Road	Hope Creek	Bridge				
220/221	417	Connie Wright Road	Bookman Creek	Bridge				
223/224		South Hampton Rd.	Hope Creek	2 - 60 in RCP	30	0.0018	4	2

Ditch #	From Node	To Node	Length (ft)	US Elev. (ft)	DS Elev. (ft)	Slope (%)	Avg. Width	Side Slope	n-value	Road Xing Node #
1	110	1	103	350	348	1.94%	12	5	0.05	001/002
101	2	3	1387	348	330	1.30%	12	5	0.05	001/002
2	3	130	318	330	319	3.46%	6	3	0.05	130/140
201	140	4	451	319	308	2.44%	6	3	0.05	130/140
3	4	5	621	308	301	1.13%	15	3	0.05	005/006
4	6	7	462	301	289	2.60%	15	3	0.05	005/006
5	7	8	76	289	289	0.00%	20	0.5	0.05	008/009
6	9	101	660	289	286	0.45%	20	0.5	0.05	008/009
7	101	10	662	279	279	1.06%	20	3	0.05	010/011
8	11	12	577	279	271	1.39%	20	3	0.05	010/011
9	12	13	948	271	260	1.16%	10	3	0.05	010/011 - 014/015
10	13	14	340	260	260	0.00%	10	3	0.05	014/015
11	15	16	1832	260	242	0.98%	10	3	0.05	014/015
12	16	17	246	242	238	1.63%	20	2	0.05	017/018
13	18	19	857	238	233	0.58%	20	2	0.05	017/018 - 019/020
14	20	21	427	233	231	0.47%	20	2	0.05	019/020
15	21	22	223	231	229	0.90%	10	5	0.05	019/020 - 023/024
16	22	23	572	229	221	1.40%	10	5	0.05	023/024
17	24	25	766	221	209	1.57%	10	5	0.05	023/024

Ditch #	From Node	To Node	Length (ft)	US Elev. (ft)	DS Elev. (ft)	Slope (%)	Avg. Width	Side Slope	n-value	Road Xing Node #
18	26	27	686	209	201	1.17%	10	5	0.05	023/024
19	28	29	1616	201	178	1.42%	10	5	0.05	023/024
20	219	21	712	235	229	0.84%	10	5	0.05	218/219
21	224	218	757	255	235	2.64%	10	5	0.05	223/224 - 218/219
210	211	223	118	256	255	0.85%	10	5	0.05	223/224
22	213	211	103	276	256	19.42%	5	2	0.05	212/213
23	214	212	1297	320	276	3.39%	5	2	0.05	212/213
24	216	211	965	268	255	1.35%	5	2	0.05	
25	217	216	1545	359	268	5.89%	5	2	0.05	
26	73	71	541	359	268	3.14%	15	3	0.05	072/073
27	75	72	576	334	309	4.34%	12.5	3	0.05	074/075 - 072/073
28	86	74	374	350	334	4.28%	10	3	0.05	085/086 - 074/075
29	84	85	1366	400	350	3.66%	10	3	0.05	085/086
30	76	71	925	309	292	1.84%	10	3	0.05	077/078
31	78	76	135	319	309	7.41%	10	3	0.05	077/078
32	80	77	410	327	319	1.95%	6	2	0.05	079/080 - 077/078
33	82	79	1083	349	327	2.03%	6	2	0.05	081/082 - 079/080
34	83	81	413	378	349	7.02%	6	2	0.05	081/082

Ditch #	From Node	To Node	Length (ft)	US Elev. (ft)	DS Elev. (ft)	Slope (%)	Avg. Width	Side Slope	n-value	Road Xing Node #
35	221	22	1418	270	226	3.10%	5	3	0.05	220/221
36	226	220	67	270	270	0.00%	5	3	0.05	225/226 - 220/221
360	222	225	639	306	270	5.63%	5	3	0.05	225/226

BASINID	CENTROIDX	CENTROIDY	BASINAREA (m^2)	BASINAREA (acres)	PERIMETER (m)	Max. Flow Distance (m)	Max. Flow Distance (ft)	MEANELEV (ft)	BASINSLOP
1	481039.8	3780699.8	951002	235.00	4993	1386	4547.24	327.61	9.552
2	479654.7	3780563.0	1113596	275.18	5677	2151	7057.09	340.25	9.520
3	476559.4	3780409.1	1492593	368.83	7319	2418	7933.07	379.89	6.228
5	478269.5	3780460.4	1016507	251.18	5746	1881	6171.26	359.74	6.643
6	478303.7	3779708.0	1170	0.29	137	0	0.00	309.00	1.068
7	476627.9	3779537.0	1170	0.29	137	42	137.80	350.00	2.386
8	480543.9	3780289.4	660905	163.31	5541	9579	31427.17	304.12	10.008
9	477807.8	3779998.7	805953	199.16	5404	5343	17529.53	350.32	8.295
10	482493.4	3779879.0	904212	223.44	5062	1589	5213.25	301.58	8.642
11	476696.3	3779708.0	935795	231.24	6635	4481	14701.44	371.73	8.637
12	475584.7	3779844.8	1955811	483.29	8687	2608	8556.43	395.61	6.049

BASINID	CENTROIDX	CENTROIDY	BASINAREA (m^2)	BASINAREA (acres)	PERIMETER (m)	Max. Flow Distance (m)	Max. Flow Distance (ft)	MEANELEV (ft)	BASINSLOP
13	478560.2	3779297.6	1094880	270.55	5541	6497	21315.62	332.23	7.807
14	482818.3	3779160.8	913570	225.75	5609	1669	5475.72	265.16	10.169
15	481330.6	3779776.4	2795687	690.83	11287	2031	6663.39	301.83	10.565
17	482356.6	3778254.4	1380298	341.08	6703	5753	18874.67	279.68	10.817
16	479535.0	3779143.7	2889267	713.95	11971	8607	28238.19	325.45	9.290
19	480988.5	3778134.7	1627113	402.07	6909	2338	7670.60	325.98	9.716
18	475875.4	3778510.9	3003902	742.28	10466	3444	11299.21	405.79	7.350
20	484494.2	3778630.7	3394596	838.82	10260	6982	22906.82	265.38	13.908
21	477346.1	3778339.9	2602680	643.14	10329	3624	11889.76	378.53	7.589
22	481621.3	3777245.5	1170	0.29	137	42	137.80	302.00	20.129

BASINID	CENTROIDX	CENTROIDY	BASINAREA (m^2)	BASINAREA (acres)	PERIMETER (m)	Max. Flow Distance (m)	Max. Flow Distance (ft)	MEANELEV (ft)	BASINSLOP
23	482014.6	3777553.3	760333	187.88	4993	4174	13694.23	309.75	13.133
24	479449.5	3777792.7	1292567	319.40	7798	4039	13251.31	350.07	8.933
25	483006.4	3777177.1	2767614	683.89	9918	5963	19563.65	328.50	11.915
26	480783.3	3776732.5	1953472	482.71	8345	2835	9301.18	365.93	10.046
27	477824.9	3776903.5	3381729	835.64	9850	3040	9973.75	381.83	8.444
28	479415.3	3776698.3	2036524	503.24	7935	2967	9734.25	384.84	9.017
29	481279.3	3776270.7	2491554	615.68	9782	3119	10232.94	378.47	11.230

Total Area = 10928

Appendix 2 – Rating Curves

Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.019400 ft/ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V
Bottom Width	12.00 ft

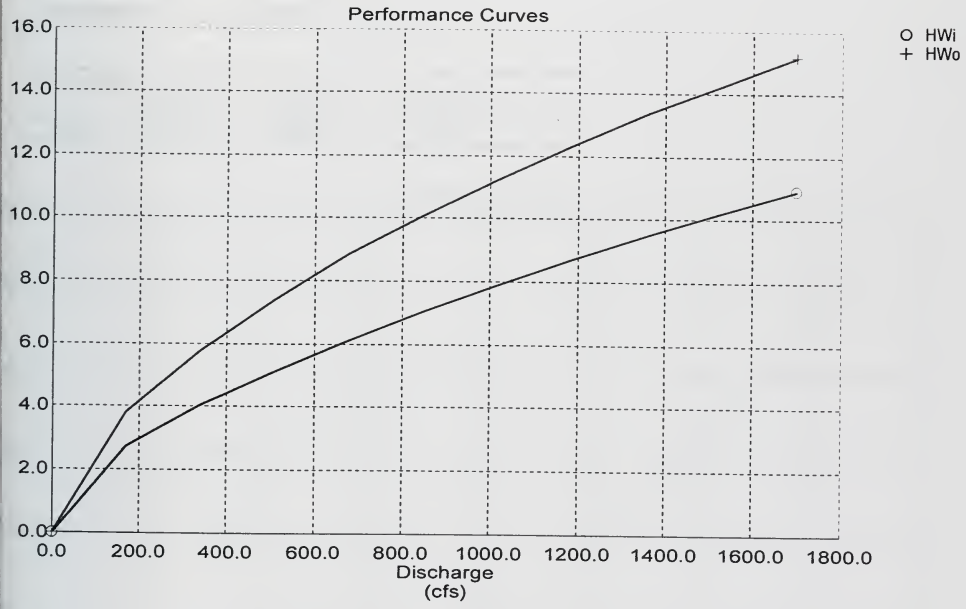
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	15.00	1.00 ft



Performance Curves Report
001

ange Data:

	Minimum	Maximum	Increment
ischarge	0.00	1,700.00	170.00 cfs



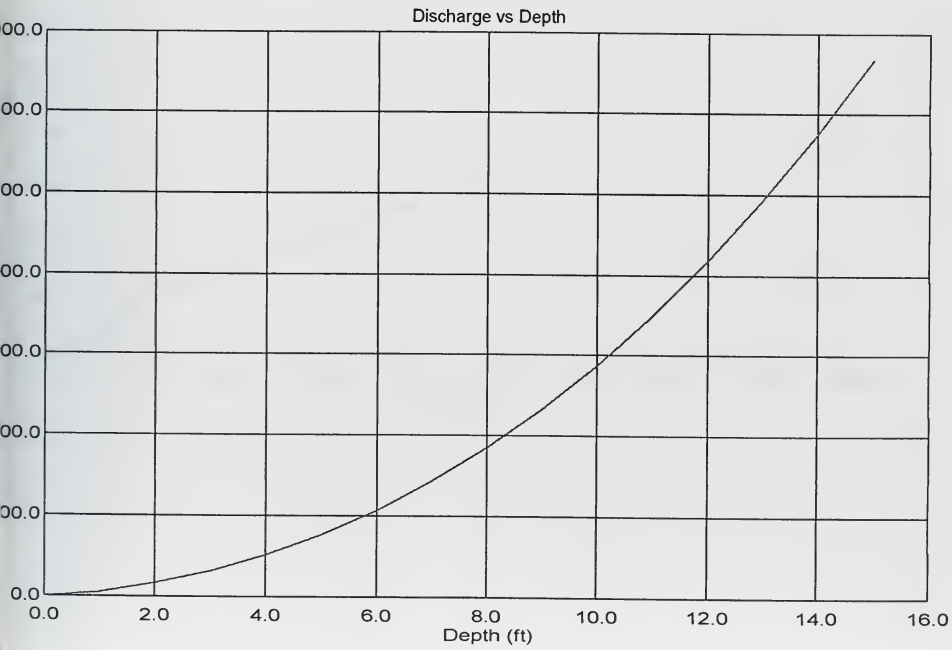
Curve

Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	3
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data		
Mannings Coefficient	0.050	
Channel Slope	0.011300	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	0.000000	H : V
Bottom Width	15.00	ft

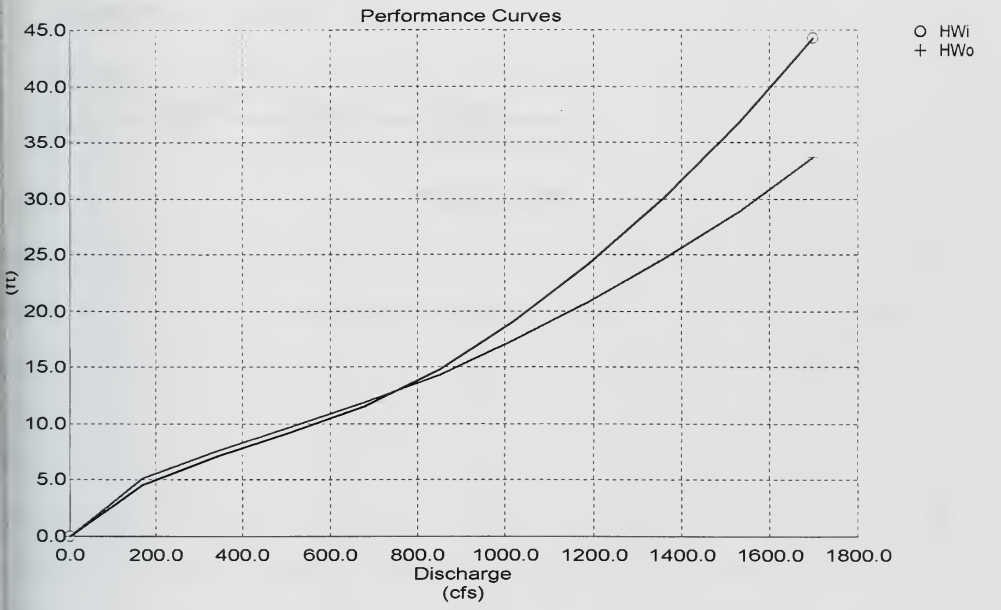
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	15.00	1.00 ft



Performance Curves Report
005

Range Data:

	Minimum	Maximum	Increment
Discharge	0.00	1,700.00	170.00 cfs



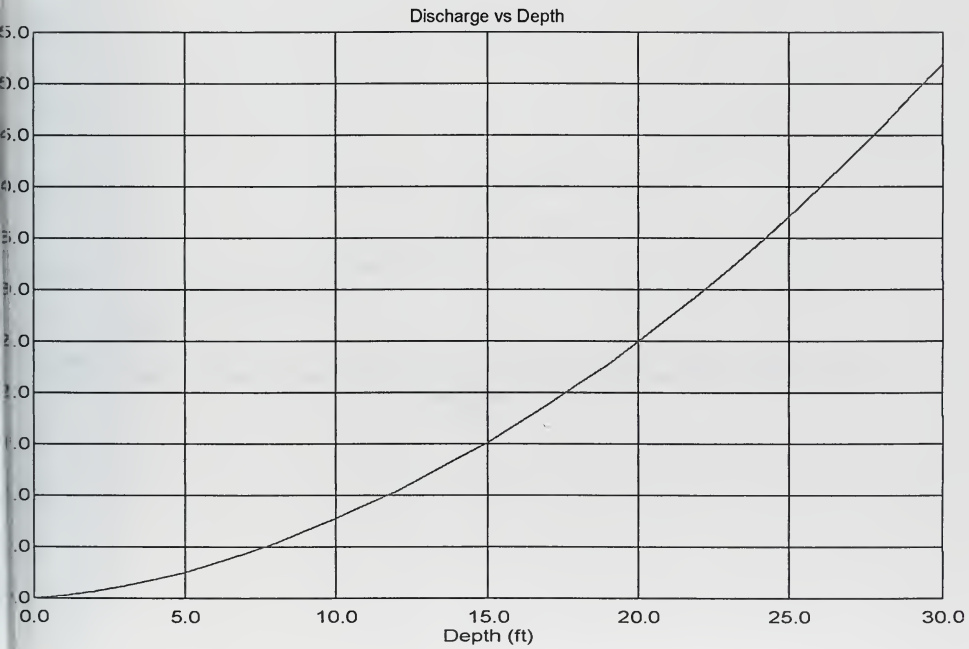
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Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	5
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

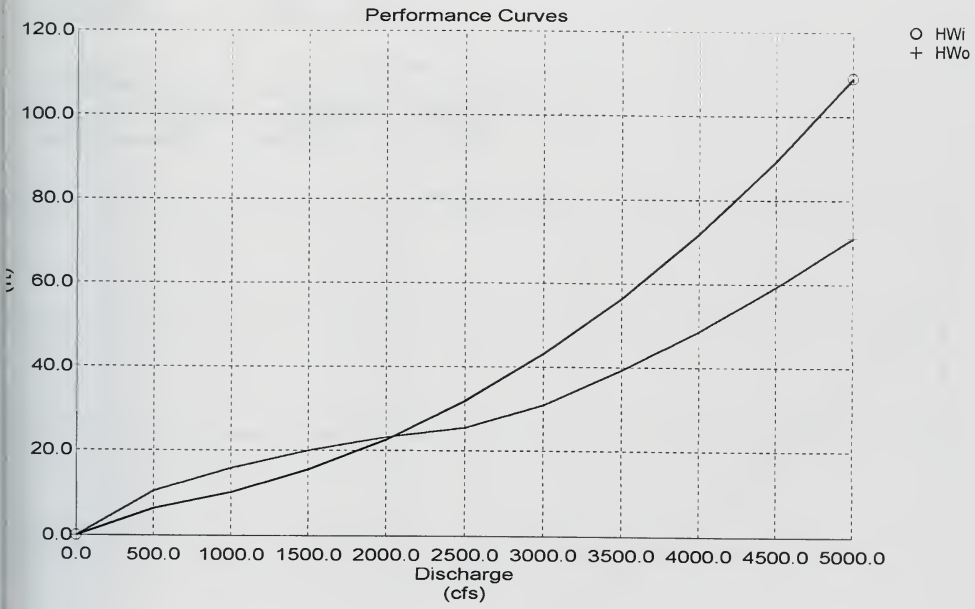
Constant Data		
Mannings Coefficient	0.050	
Channel Slope	1.0e-7	ft/ft
Left Side Slope	0.500000	H : V
Right Side Slope	0.500000	H : V
Bottom Width	20.00	ft

Input Data			
	Minimum	Maximum	Increment
Depth	0.00	30.00	1.00 ft



Performance Curves Report
008

Range Data:			
	Minimum	Maximum	Increment
Discharge	0.00	5,000.00	500.00 cfs

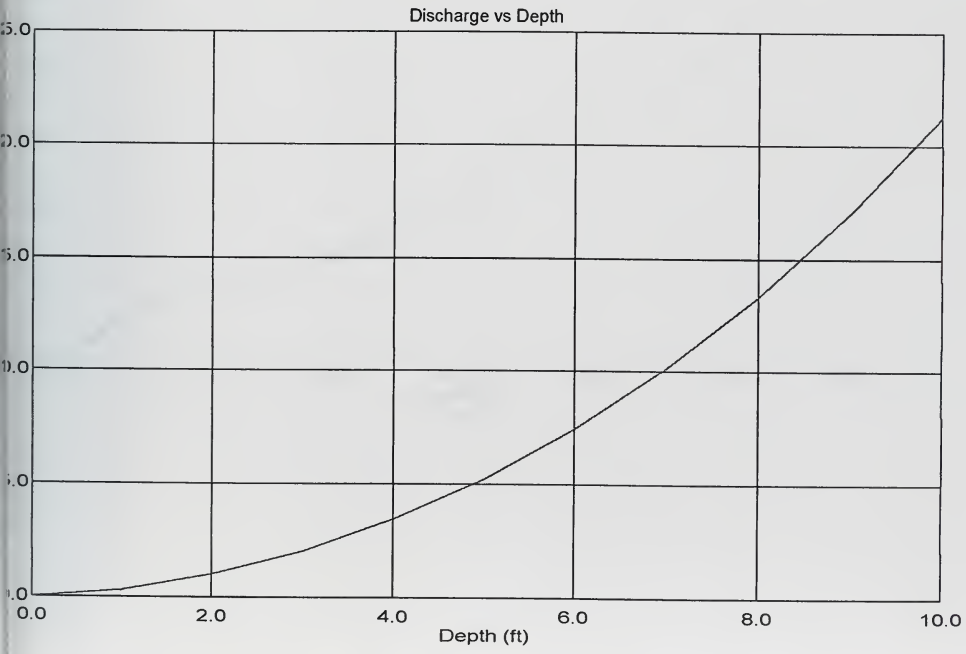


Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	10
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.000001 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	0.000000 H : V
Bottom Width	10.00 ft

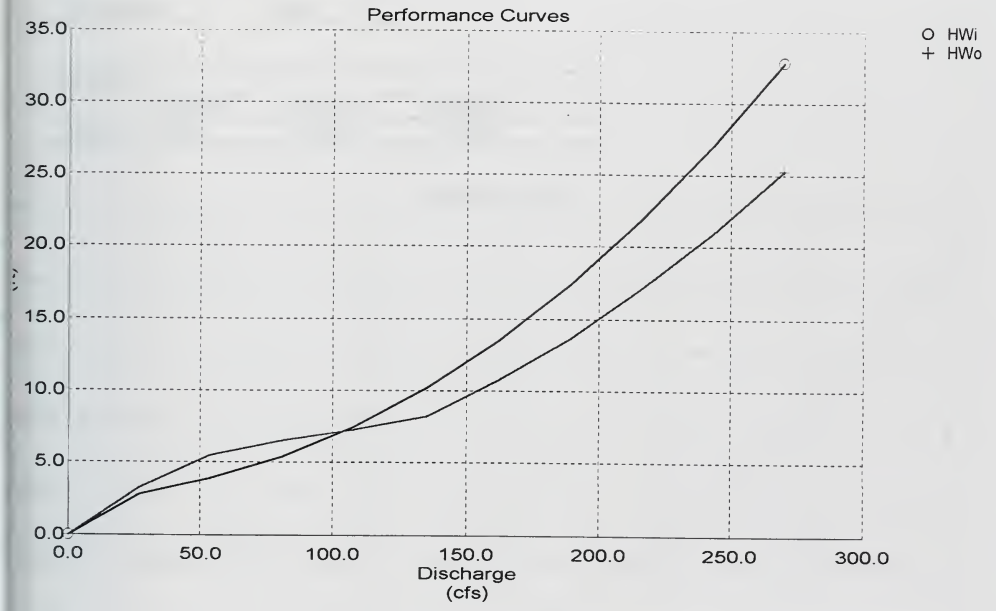
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	10.00	1.00 ft



Performance Curves Report
014

Range Data:

	Minimum	Maximum	Increment
Discharge	0.00	270.00	27.00 cfs

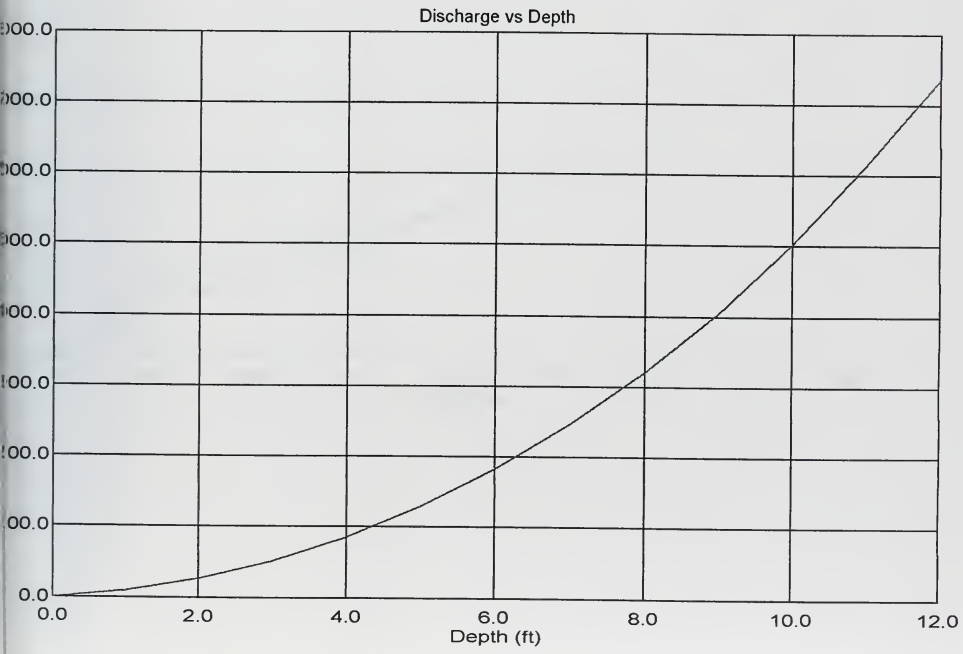


Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	27
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.043400 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	0.000000 H : V
Bottom Width	12.50 ft

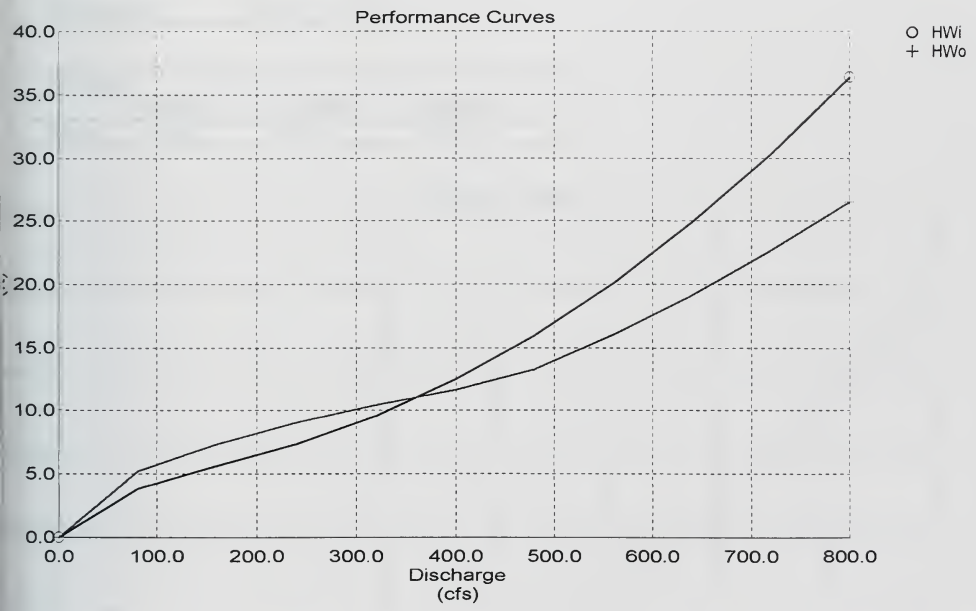
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	12.00	1.00 ft



Performance Curves Report
072

ange Data:

	Minimum	Maximum	Increment
Discharge	0.00	800.00	80.00 cfs



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Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	untitled.fm2
Worksheet	28
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.042800 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	0.000000 H : V
Bottom Width	10.00 ft

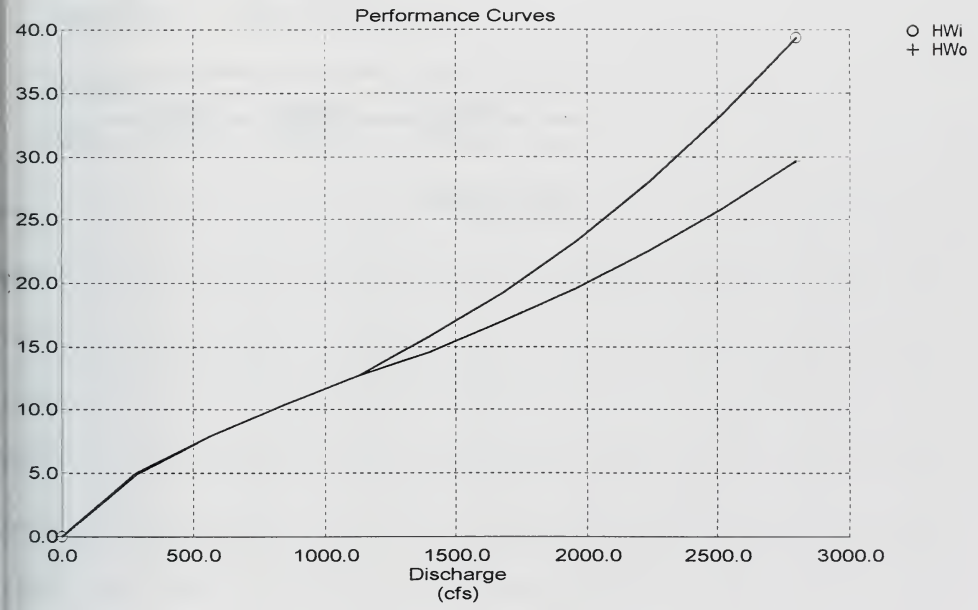
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	16.00	1.00 ft



Performance Curves Report
074

ange Data:

	Minimum	Maximum	Increment
ischarge	0.00	2,800.00	280.00 cfs



Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	c:\grad school\summer 99\hollinhead watershed\streams.fm2
Worksheet	33
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.020300 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	6.00 ft

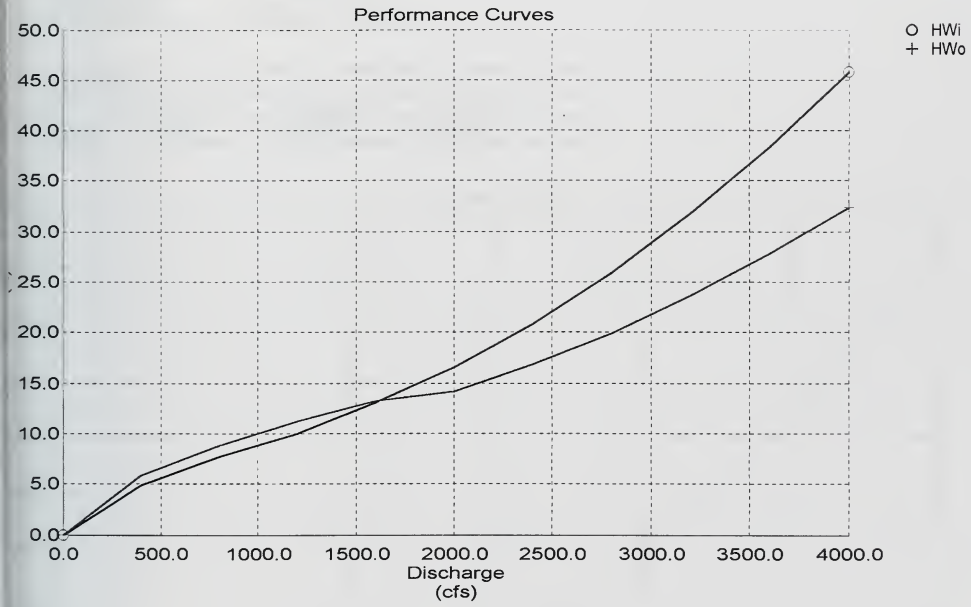
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	15.00	1.00 ft



Performance Curves Report
079

ange Data:

	Minimum	Maximum	Increment
Discharge	0.00	4,000.00	400.00 cfs



Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	c:\grad school\summer 99\hollinhead watershed\streams.fm2
Worksheet	34
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.070200 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	6.00 ft

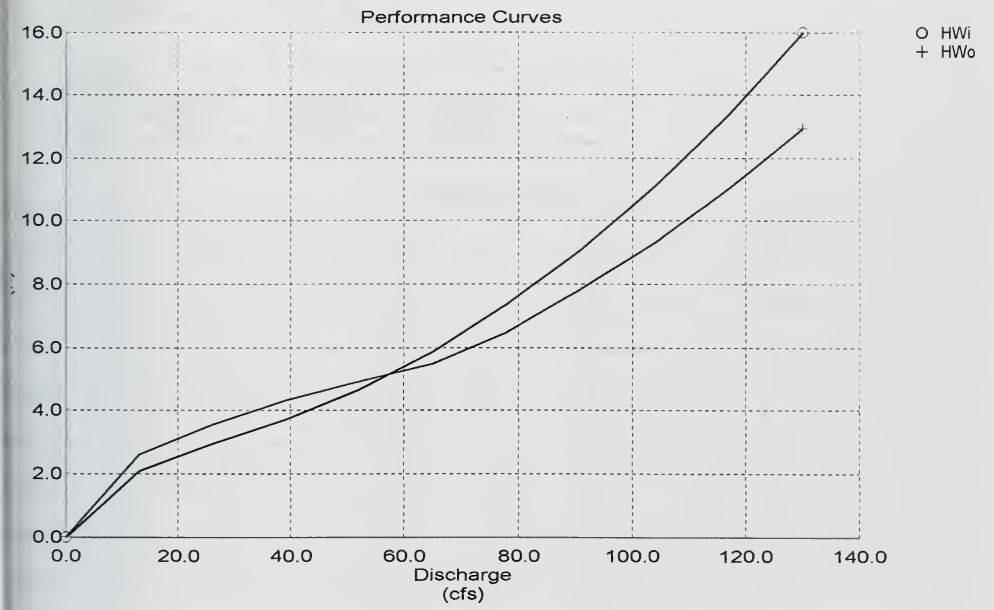
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	6.00	1.00 ft



Performance Curves Report
081

ange Data:

	Minimum	Maximum	Increment
Discharge	0.00	130.00	13.00 cfs

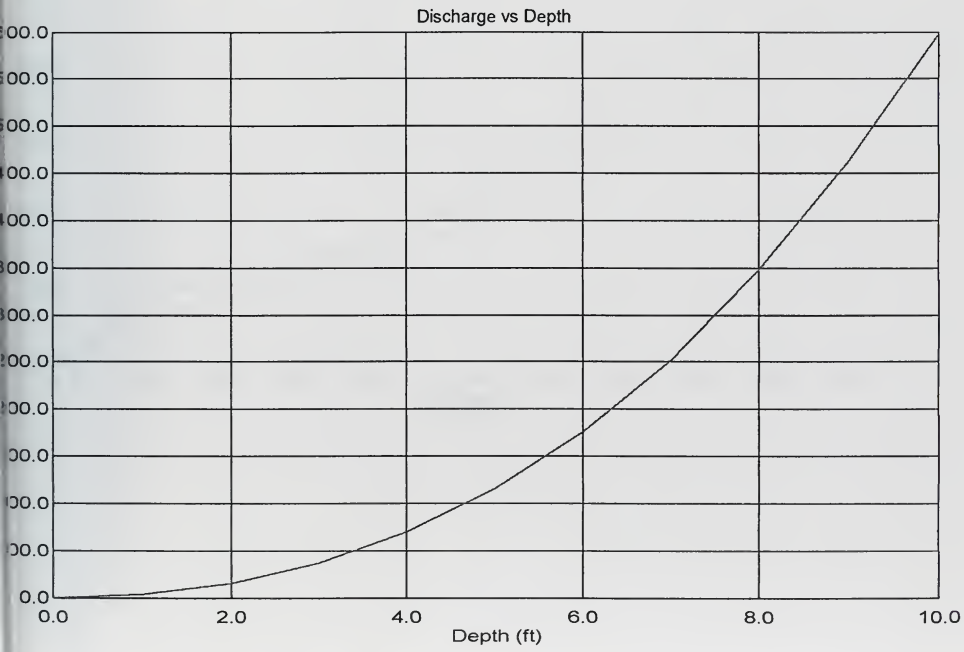


Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	c:\grad school\summer 99\hollinhead watershed\streams.fm2
Worksheet	2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.034600 ft/ft
Left Side Slope	3.000000 H : V
Right Side Slope	3.000000 H : V
Bottom Width	6.00 ft

Input Data			
	Minimum	Maximum	Increment
Depth	0.00	10.00	1.00 ft

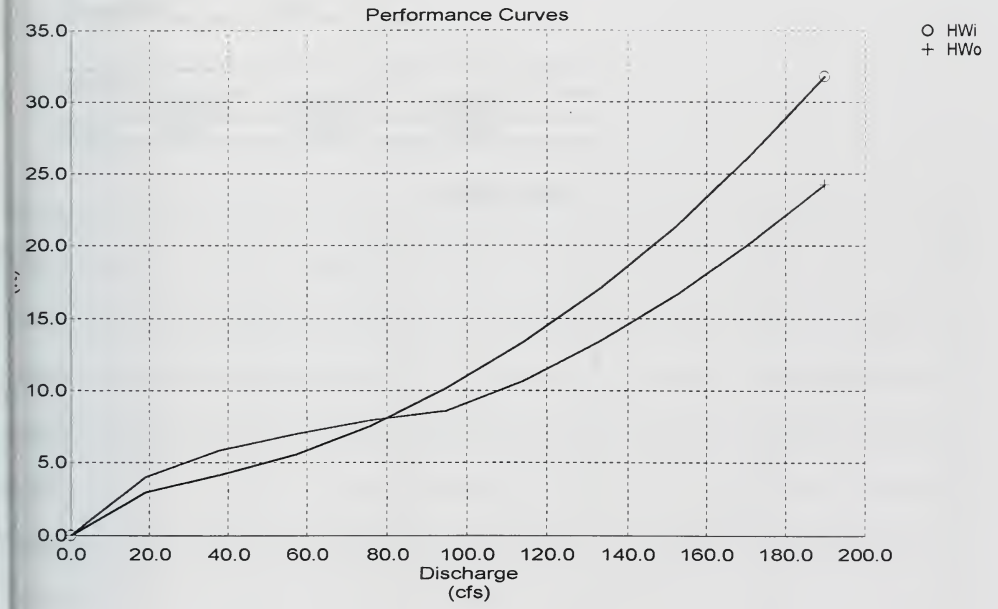


Performance Curves Report

130

Range Data:

	Minimum	Maximum	Increment
Discharge	0.00	190.00	19.00 cfs

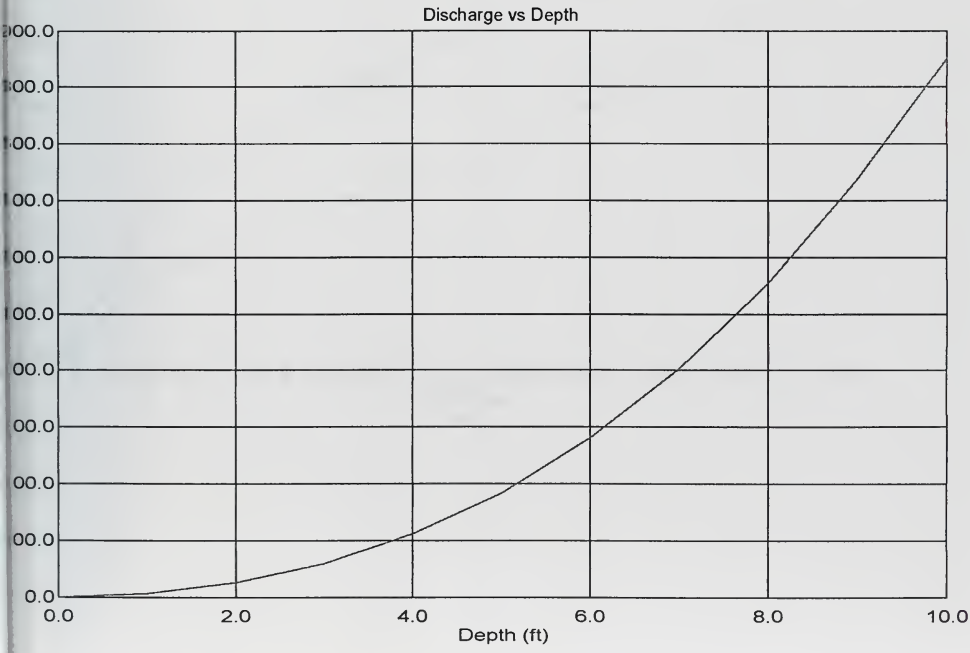


Curve
Plotted Curves for Trapezoidal Channel

Project Description	
Project File	c:\grad school\summer 99\hollinhead watershed\streams.fm2
Worksheet	210
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Constant Data	
Mannings Coefficient	0.050
Channel Slope	0.008500 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	4.00 ft

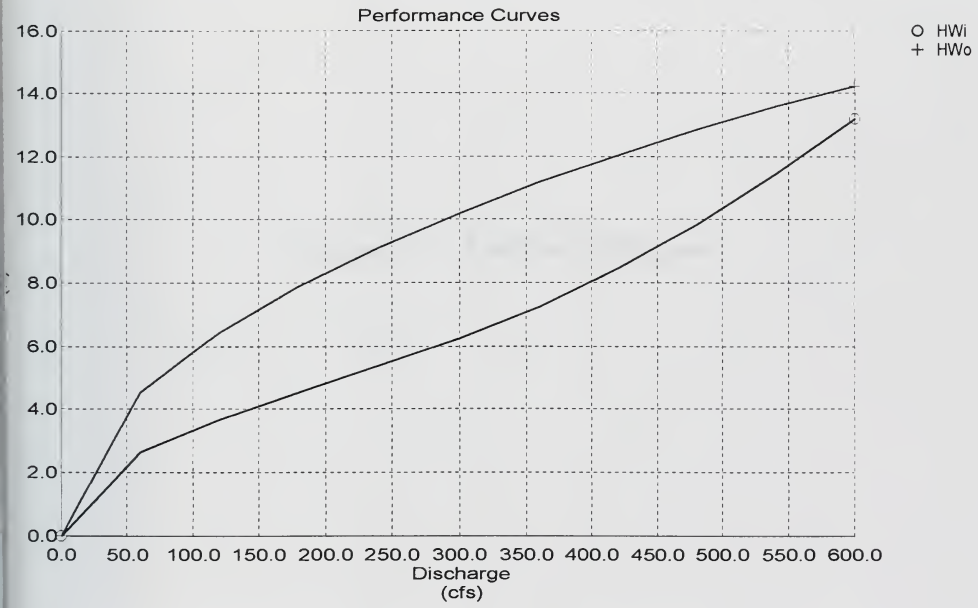
Input Data			
	Minimum	Maximum	Increment
Depth	0.00	10.00	1.00 ft



Performance Curves Report
223

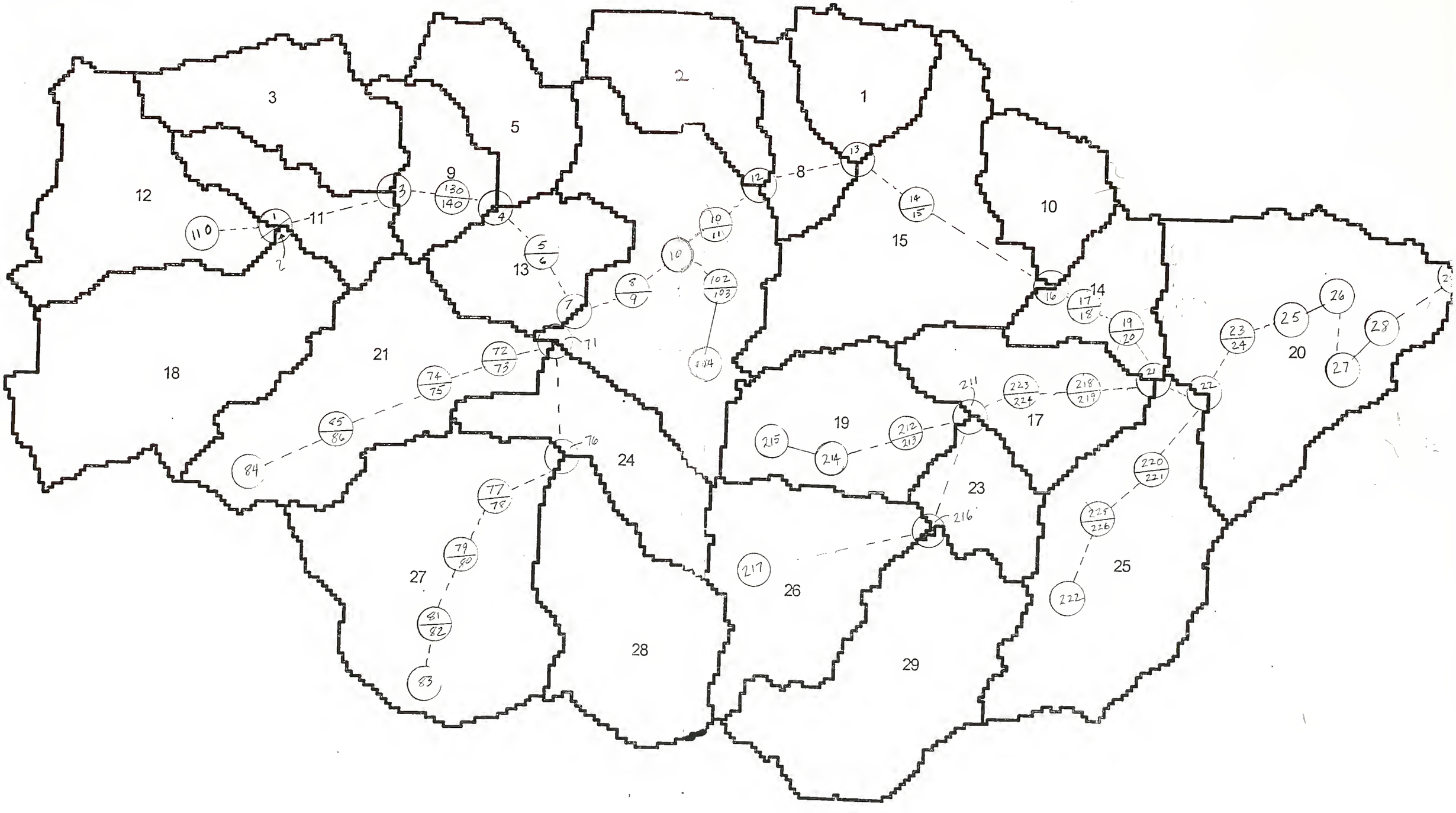
Range Data:

	Minimum	Maximum	Increment
Discharge	0.00	600.00	60.00 cfs



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Appendix 3 – Link Node Diagram


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Appendix 4 – Drain:Hydro® Summary Output

```
 ------------------------------------------------
|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 10-AUG-9     Time: 12:29:19            |
 ------------------------------------------------

      INPUT FILE: INPUT (PAST)

      Rainfall RP =  25 yrs and P =  6.35 inches
```

SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.15	556.8	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.01	294.8	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	2.89	282.1	13.58
24	319.4	13251.	8.93	68.9	183.	115.7	2.98	148.9	13.50
12	483.3	8556.	6.05	71.4	188.	92.6	3.22	284.9	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.09	1.0	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	2.68	181.4	13.25
5	251.2	6171.	6.64	70.3	181.	70.1	3.11	172.6	12.83
13	270.6	6497.	7.81	69.6	185.	68.7	3.05	184.7	12.83
2	275.2	7057.	9.52	69.9	182.	65.9	3.08	205.3	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	2.90	205.5	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	2.68	141.9	12.75
19	402.1	7671.	9.72	69.8	211.	69.9	3.07	307.6	12.83
26	482.7	9301.	10.05	67.6	189.	85.1	2.85	266.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.09	1.0	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.24	132.7	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.29	118.2	12.83
25	683.9	19564.	11.91	65.5	182.	149.7	2.66	227.5	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	2.56	508.7	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

		CONDUIT DATA				PEAK FLOW DATA				
CONNECTING NODE	NOS	CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	557.	13.00	557.	13.08
81	79	2	1083.	2.03	6.	0.050	557.	13.08	557.	13.08
79	77	2	410.	1.95	6.	0.050	557.	13.08	557.	13.08
77	76	2	135.	7.41	10.	0.050	557.	13.08	557.	13.08
76	71	2	925.	1.84	10.	0.050	851.	13.08	851.	13.08
84	85	2	1366.	3.66	10.	0.050	282.	13.58	282.	13.67
85	74	2	374.	4.28	10.	0.050	282.	13.67	282.	13.67
74	72	2	576.	4.34	13.	0.050	282.	13.67	282.	13.67
72	71	2	541.	3.14	15.	0.050	282.	13.67	282.	13.67
71	7	2	10.	0.05	5.	0.050	1270.	13.25	1269.	13.25
110	1	2	103.	1.94	12.	0.050	285.	13.17	285.	13.17
1	3	2	1387.	1.30	12.	0.050	285.	13.17	285.	13.25
3	130	2	318.	3.46	6.	0.050	466.	13.25	466.	13.25
130	4	2	451.	2.44	6.	0.050	466.	13.25	466.	13.25
4	5	2	621.	1.13	15.	0.050	634.	13.17	634.	13.17
5	7	2	462.	2.60	15.	0.050	634.	13.17	634.	13.17
7	8	2	76.	0.01	20.	0.050	2082.	13.17	2080.	13.17
8	101	2	660.	0.45	20.	0.050	2080.	13.17	2079.	13.17
101	10	2	662.	1.06	20.	0.050	2079.	13.17	2079.	13.25
10	12	2	577.	1.39	20.	0.050	2079.	13.25	2079.	13.25
12	13	2	948.	1.16	5.	0.050	2271.	13.17	2270.	13.17
13	14	2	340.	0.01	5.	0.050	2441.	13.17	2439.	13.17
14	16	2	1832.	0.98	5.	0.050	2439.	13.17	2439.	13.17
16	17	2	246.	1.63	20.	0.050	2575.	13.17	2574.	13.17
17	19	2	857.	0.58	20.	0.050	2574.	13.17	2574.	13.17
19	21	2	427.	0.47	20.	0.050	2574.	13.17	2573.	13.17
214	212	2	1297.	3.39	20.	0.050	308.	12.83	308.	12.83
212	211	2	103.	10.00	20.	0.050	308.	12.83	307.	12.83
217	216	2	1545.	5.89	5.	0.050	266.	13.08	266.	13.17
216	211	2	965.	1.37	10.	0.050	266.	13.17	266.	13.17
211	223	2	118.	0.85	4.	0.050	701.	13.00	701.	13.00
223	218	2	757.	2.64	10.	0.050	701.	13.00	701.	13.00
218	21	2	712.	0.84	10.	0.050	701.	13.00	701.	13.00
21	22	2	223.	0.90	10.	0.050	3384.	13.17	3384.	13.17
222	225	2	639.	5.63	10.	0.050	228.	14.00	228.	14.08
225	220	2	67.	0.01	10.	0.050	228.	14.08	227.	14.08
220	22	2	1418.	3.10	5.	0.050	227.	14.08	227.	14.08
22	23	2	572.	1.40	10.	0.050	3590.	13.17	3589.	13.17
23	25	2	766.	1.57	10.	0.050	3589.	13.17	3588.	13.17
25	27	2	686.	1.17	10.	0.050	3588.	13.17	3587.	13.25
27	29	2	1616.	1.42	10.	0.050	3587.	13.25	3587.	13.25

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	201	304	28	851.	13.08	3.10	0.0	1338.8
71	202	305	309	1122.	13.25	3.03	0.0	1981.9
71	203	24	202	1270.	13.25	3.02	0.0	2301.3
1	204	7	311	285.	13.17	3.22	0.0	483.6
3	205	312	3	466.	13.25	2.99	0.0	852.4
4	206	5	314	634.	13.17	3.02	0.0	1103.6
7	207	13	310	1448.	13.17	3.03	0.0	2571.9
7	208	316	207	2082.	13.17	3.02	0.0	3675.5
12	209	320	2	2271.	13.17	3.03	0.0	3950.7
13	210	321	1	2441.	13.17	3.02	0.0	4185.7
16	211	10	323	2575.	13.17	3.00	0.0	4409.1
216	212	22	329	266.	13.17	2.85	0.0	483.0
211	213	328	330	569.	13.00	2.95	0.0	885.1
211	214	23	213	701.	13.00	3.00	0.0	1073.0
21	215	326	14	2687.	13.17	2.97	0.0	4634.9
21	216	333	215	3384.	13.17	2.97	0.0	5707.9
22	217	334	337	3590.	13.17	2.94	0.0	6391.8
29	218	341	20	4069.	13.17	2.90	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 10-AUG-9     Time: 12:34:37            |
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      INPUT FILE: input50  (PAST)

      Rainfall RP =  50 yrs and P =  7.15 inches
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SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.82	680.9	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.66	362.7	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	3.53	348.7	13.58
24	319.4	13251.	8.93	68.9	183.	115.7	3.63	183.3	13.42
12	483.3	8556.	6.05	71.4	188.	92.6	3.89	347.5	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.74	1.2	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	3.30	226.5	13.25
5	251.2	6171.	6.64	70.3	181.	70.1	3.78	211.5	12.83
13	270.6	6497.	7.81	69.6	185.	68.7	3.70	227.0	12.83
2	275.2	7057.	9.52	69.9	182.	65.9	3.73	251.8	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	3.54	254.1	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.30	177.5	12.75
19	402.1	7671.	9.72	69.8	211.	69.9	3.72	377.4	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	3.49	329.6	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.74	1.2	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.91	161.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.86	151.2	12.83
25	683.9	19564.	11.91	65.5	182.	149.7	3.27	284.1	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	3.17	640.6	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE	NOS	CODE NO	CONDUIT DATA LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	681.	13.00	681.	13.00
81	79	2	1083.	2.03	6.	0.050	681.	13.00	680.	13.08
79	77	2	410.	1.95	6.	0.050	680.	13.08	680.	13.08
77	76	2	135.	7.41	10.	0.050	680.	13.08	680.	13.08
76	71	2	925.	1.84	10.	0.050	1043.	13.08	1043.	13.08
84	85	2	1366.	3.66	10.	0.050	349.	13.58	349.	13.58
85	74	2	374.	4.28	10.	0.050	349.	13.58	349.	13.58
74	72	2	576.	4.34	13.	0.050	349.	13.58	349.	13.58
72	71	2	541.	3.14	15.	0.050	349.	13.58	349.	13.67
71	7	2	10.	0.05	5.	0.050	1559.	13.25	1559.	13.25
110	1	2	103.	1.94	12.	0.050	347.	13.17	347.	13.17
1	3	2	1387.	1.30	12.	0.050	348.	13.17	347.	13.25
3	130	2	318.	3.46	6.	0.050	574.	13.25	574.	13.25
130	4	2	451.	2.44	6.	0.050	574.	13.25	574.	13.25
4	5	2	621.	1.13	15.	0.050	779.	13.08	779.	13.17
5	7	2	462.	2.60	15.	0.050	779.	13.17	779.	13.17
7	8	2	76.	0.01	20.	0.050	2559.	13.17	2557.	13.17
8	101	2	660.	0.45	20.	0.050	2557.	13.17	2557.	13.17
101	10	2	662.	1.06	20.	0.050	2557.	13.17	2556.	13.17
10	12	2	577.	1.39	20.	0.050	2556.	13.17	2555.	13.17
12	13	2	948.	1.16	5.	0.050	2792.	13.17	2792.	13.17
13	14	2	340.	0.01	5.	0.050	3004.	13.08	3003.	13.08
14	16	2	1832.	0.98	5.	0.050	3003.	13.08	3001.	13.17
16	17	2	246.	1.63	20.	0.050	3172.	13.08	3172.	13.08
17	19	2	857.	0.58	20.	0.050	3172.	13.08	3170.	13.17
19	21	2	427.	0.47	20.	0.050	3170.	13.17	3170.	13.17
214	212	2	1297.	3.39	20.	0.050	377.	12.75	377.	12.83
212	211	2	103.	10.00	20.	0.050	377.	12.83	377.	12.83
217	216	2	1545.	5.89	5.	0.050	330.	13.08	329.	13.08
216	211	2	965.	1.37	10.	0.050	330.	13.08	329.	13.17
211	223	2	118.	0.85	4.	0.050	862.	13.00	862.	13.00
223	218	2	757.	2.64	10.	0.050	862.	13.00	862.	13.00
218	21	2	712.	0.84	10.	0.050	862.	13.00	862.	13.00
21	22	2	223.	0.90	10.	0.050	4175.	13.08	4175.	13.08
222	225	2	639.	5.63	10.	0.050	284.	14.00	284.	14.00
225	220	2	67.	0.01	10.	0.050	284.	14.00	283.	14.00
220	22	2	1418.	3.10	5.	0.050	283.	14.00	283.	14.08
22	23	2	572.	1.40	10.	0.050	4431.	13.17	4431.	13.17
23	25	2	766.	1.57	10.	0.050	4431.	13.17	4430.	13.17
25	27	2	686.	1.17	10.	0.050	4430.	13.17	4429.	13.17
27	29	2	1616.	1.42	10.	0.050	4429.	13.17	4426.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	201	304	28	1043.	13.08	3.76	0.0	1338.8
71	202	305	309	1378.	13.17	3.68	0.0	1981.9
71	203	24	202	1559.	13.25	3.68	0.0	2301.3
1	204	7	311	348.	13.17	3.89	0.0	483.6
3	205	312	3	574.	13.25	3.64	0.0	852.4
4	206	5	314	779.	13.08	3.67	0.0	1103.6
7	207	13	310	1780.	13.17	3.68	0.0	2571.9
7	208	316	207	2559.	13.17	3.68	0.0	3675.5
12	209	320	2	2792.	13.17	3.68	0.0	3950.7
13	210	321	1	3004.	13.08	3.67	0.0	4185.7
16	211	10	323	3172.	13.08	3.65	0.0	4409.1
216	212	22	329	330.	13.08	3.49	0.0	483.0
211	213	328	330	701.	12.92	3.60	0.0	885.1
211	214	23	213	862.	13.00	3.65	0.0	1073.0
21	215	326	14	3315.	13.08	3.61	0.0	4634.9
21	216	333	215	4175.	13.08	3.62	0.0	5707.9
22	217	334	337	4431.	13.17	3.58	0.0	6391.8
29	218	341	20	5036.	13.17	3.54	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 10-AUG-9     Time: 12:35:24            |
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      INPUT FILE: input100 (PA)

      Rainfall RP = 100 yrs and P =  7.80 inches
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SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	4.37	784.2	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	4.20	419.5	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	4.07	404.7	13.50
24	319.4	13251.	8.93	68.9	183.	115.7	4.17	212.2	13.42
12	483.3	8556.	6.05	71.4	188.	92.6	4.45	399.5	13.17
7	0.3	138.	2.39	70.0	180.	5.6	4.29	1.4	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	3.82	264.6	13.17
5	251.2	6171.	6.64	70.3	181.	70.1	4.33	243.9	12.83
13	270.6	6497.	7.81	69.6	185.	68.7	4.25	262.2	12.83
2	275.2	7057.	9.52	69.9	182.	65.9	4.28	290.6	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	4.08	294.8	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.82	207.4	12.75
19	402.1	7671.	9.72	69.8	211.	69.9	4.27	435.7	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	4.02	383.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	4.29	1.4	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	4.47	185.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	3.35	179.5	12.75
25	683.9	19564.	11.91	65.5	182.	149.7	3.79	331.9	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	3.68	752.0	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE	NOS	CODE NO	CONDUIT DATA LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	784.	13.00	784.	13.00
81	79	2	1083.	2.03	6.	0.050	784.	13.00	784.	13.00
79	77	2	410.	1.95	6.	0.050	784.	13.00	783.	13.00
77	76	2	135.	7.41	10.	0.050	783.	13.00	783.	13.08
76	71	2	925.	1.84	10.	0.050	1203.	13.08	1203.	13.08
84	85	2	1366.	3.66	10.	0.050	405.	13.50	405.	13.58
85	74	2	374.	4.28	10.	0.050	405.	13.58	405.	13.58
74	72	2	576.	4.34	13.	0.050	405.	13.58	405.	13.58
72	71	2	541.	3.14	15.	0.050	405.	13.58	404.	13.58
71	7	2	10.	0.05	5.	0.050	1803.	13.17	1803.	13.17
110	1	2	103.	1.94	12.	0.050	399.	13.17	399.	13.17
1	3	2	1387.	1.30	12.	0.050	400.	13.17	399.	13.17
3	130	2	318.	3.46	6.	0.050	664.	13.17	664.	13.17
130	4	2	451.	2.44	6.	0.050	664.	13.17	664.	13.25
4	5	2	621.	1.13	15.	0.050	901.	13.08	901.	13.08
5	7	2	462.	2.60	15.	0.050	901.	13.08	900.	13.17
7	8	2	76.	0.01	20.	0.050	2957.	13.17	2956.	13.17
8	101	2	660.	0.45	20.	0.050	2956.	13.17	2955.	13.17
101	10	2	662.	1.06	20.	0.050	2955.	13.17	2955.	13.17
10	12	2	577.	1.39	20.	0.050	2955.	13.17	2954.	13.17
12	13	2	948.	1.16	5.	0.050	3227.	13.17	3227.	13.17
13	14	2	340.	0.01	5.	0.050	3475.	13.08	3474.	13.08
14	16	2	1832.	0.98	5.	0.050	3474.	13.08	3473.	13.08
16	17	2	246.	1.63	20.	0.050	3673.	13.08	3672.	13.08
17	19	2	857.	0.58	20.	0.050	3672.	13.08	3671.	13.08
19	21	2	427.	0.47	20.	0.050	3671.	13.08	3670.	13.08
214	212	2	1297.	3.39	20.	0.050	436.	12.75	435.	12.83
212	211	2	103.	10.00	20.	0.050	435.	12.83	435.	12.83
217	216	2	1545.	5.89	5.	0.050	383.	13.08	383.	13.08
216	211	2	965.	1.37	10.	0.050	383.	13.08	383.	13.17
211	223	2	118.	0.85	4.	0.050	997.	12.92	997.	12.92
223	218	2	757.	2.64	10.	0.050	997.	12.92	997.	13.00
218	21	2	712.	0.84	10.	0.050	997.	13.00	997.	13.00
21	22	2	223.	0.90	10.	0.050	4838.	13.08	4837.	13.08
222	225	2	639.	5.63	10.	0.050	332.	14.00	332.	14.00
225	220	2	67.	0.01	10.	0.050	332.	14.00	331.	14.00
220	22	2	1418.	3.10	5.	0.050	331.	14.00	331.	14.00
22	23	2	572.	1.40	10.	0.050	5137.	13.08	5136.	13.08
23	25	2	766.	1.57	10.	0.050	5136.	13.08	5134.	13.17
25	27	2	686.	1.17	10.	0.050	5134.	13.17	5134.	13.17
27	29	2	1616.	1.42	10.	0.050	5134.	13.17	5132.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	219	345	28	1203.	13.08	4.31	0.0	1338.8
71	220	346	350	1593.	13.17	4.23	0.0	1981.9
71	221	24	220	1803.	13.17	4.22	0.0	2301.3
1	222	7	352	400.	13.17	4.45	0.0	483.6
3	223	353	3	664.	13.17	4.18	0.0	852.4
4	224	5	355	901.	13.08	4.21	0.0	1103.6
7	225	13	351	2057.	13.17	4.22	0.0	2571.9
7	226	357	225	2957.	13.17	4.22	0.0	3675.5
12	227	361	2	3227.	13.17	4.23	0.0	3950.7
13	228	362	1	3475.	13.08	4.22	0.0	4185.7
16	229	10	364	3673.	13.08	4.20	0.0	4409.1
216	230	22	370	383.	13.08	4.02	0.0	483.0
211	231	369	371	812.	12.92	4.14	0.0	885.1
211	232	23	231	997.	12.92	4.19	0.0	1073.0
21	233	367	14	3844.	13.08	4.16	0.0	4634.9
21	234	374	233	4838.	13.08	4.16	0.0	5707.9
22	235	375	378	5137.	13.08	4.12	0.0	6391.8
29	236	382	20	5847.	13.08	4.07	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996    |
|   University of South Carolina                |
|   Dept of Civil and Environmental Engineering |
|   Date: 10-AUG-9     Time: 13:30:23           |
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INPUT FILE: INPUT (PR)

Rainfall RP = 25 yrs and P = 6.35 inches

SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.15	556.8	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.01	294.8	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	2.89	282.1	13.58
24	319.4	13251.	8.93	70.1	204.	112.1	3.10	170.5	13.42
12	483.3	8556.	6.05	71.4	188.	92.6	3.22	284.9	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.09	1.0	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	2.68	181.4	13.25
5	251.2	6171.	6.64	70.3	181.	70.1	3.11	172.6	12.83
13	270.6	6497.	7.81	70.5	203.	67.0	3.13	206.1	12.83
2	275.2	7057.	9.52	69.9	182.	65.9	3.08	205.3	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	2.90	205.5	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	2.68	141.9	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	3.15	334.5	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	2.85	266.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.09	1.0	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.24	132.7	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.29	118.2	12.83
25	683.9	19564.	11.91	65.5	182.	149.7	2.66	227.5	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	2.56	508.7	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA: CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA: INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	557.	13.00	557.	13.08
81	79	2	1083.	2.03	6.	0.050	557.	13.08	557.	13.08
79	77	2	410.	1.95	6.	0.050	557.	13.08	557.	13.08
77	76	2	135.	7.41	10.	0.050	557.	13.08	557.	13.08
76	71	2	925.	1.84	10.	0.050	851.	13.08	851.	13.08
84	85	2	1366.	3.66	10.	0.050	282.	13.58	282.	13.67
85	74	2	374.	4.28	10.	0.050	282.	13.67	282.	13.67
74	72	2	576.	4.34	13.	0.050	282.	13.67	282.	13.67
72	71	2	541.	3.14	15.	0.050	282.	13.67	282.	13.67
71	7	2	10.	0.05	5.	0.050	1292.	13.25	1292.	13.25
110	1	2	103.	1.94	12.	0.050	285.	13.17	285.	13.17
1	3	2	1387.	1.30	12.	0.050	285.	13.17	285.	13.25
3	130	2	318.	3.46	6.	0.050	466.	13.25	466.	13.25
130	4	2	451.	2.44	6.	0.050	466.	13.25	466.	13.25
4	5	2	621.	1.13	15.	0.050	634.	13.17	634.	13.17
5	7	2	462.	2.60	15.	0.050	634.	13.17	634.	13.17
7	8	2	76.	0.01	20.	0.050	2122.	13.17	2120.	13.17
8	101	2	660.	0.45	20.	0.050	2120.	13.17	2120.	13.17
101	10	2	662.	1.06	20.	0.050	2120.	13.17	2119.	13.17
10	12	2	577.	1.39	20.	0.050	2119.	13.17	2119.	13.25
12	13	2	948.	1.16	5.	0.050	2312.	13.17	2311.	13.17
13	14	2	340.	0.01	5.	0.050	2482.	13.08	2480.	13.17
14	16	2	1832.	0.98	5.	0.050	2480.	13.17	2480.	13.17
16	17	2	246.	1.63	20.	0.050	2616.	13.17	2616.	13.17
17	19	2	857.	0.58	20.	0.050	2616.	13.17	2615.	13.17
19	21	2	427.	0.47	20.	0.050	2615.	13.17	2615.	13.17
214	212	2	1297.	3.39	20.	0.050	335.	12.75	334.	12.83
212	211	2	103.	10.00	20.	0.050	334.	12.83	334.	12.83
217	216	2	1545.	5.89	5.	0.050	266.	13.08	266.	13.17
216	211	2	965.	1.37	10.	0.050	266.	13.17	266.	13.17
211	223	2	118.	0.85	4.	0.050	726.	12.92	726.	12.92
223	218	2	757.	2.64	10.	0.050	726.	12.92	726.	13.00
218	21	2	712.	0.84	10.	0.050	726.	13.00	726.	13.00
21	22	2	223.	0.90	10.	0.050	3449.	13.08	3449.	13.17
222	225	2	639.	5.63	10.	0.050	228.	14.00	228.	14.08
225	220	2	67.	0.01	10.	0.050	228.	14.08	227.	14.08
220	22	2	1418.	3.10	5.	0.050	227.	14.08	227.	14.08
22	23	2	572.	1.40	10.	0.050	3655.	13.17	3654.	13.17
23	25	2	766.	1.57	10.	0.050	3654.	13.17	3653.	13.17
25	27	2	686.	1.17	10.	0.050	3653.	13.17	3652.	13.17
27	29	2	1616.	1.42	10.	0.050	3652.	13.17	3651.	13.25

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	201	304	28	851.	13.08	3.10	0.0	1338.8
71	202	305	309	1122.	13.25	3.03	0.0	1981.9
71	203	24	202	1292.	13.25	3.04	0.0	2301.3
1	204	7	311	285.	13.17	3.22	0.0	483.6
3	205	312	3	466.	13.25	2.99	0.0	852.4
4	206	5	314	634.	13.17	3.02	0.0	1103.6
7	207	13	310	1489.	13.17	3.05	0.0	2571.9
7	208	316	207	2122.	13.17	3.04	0.0	3675.5
12	209	320	2	2312.	13.17	3.04	0.0	3950.7
13	210	321	1	2482.	13.08	3.04	0.0	4185.7
16	211	10	323	2616.	13.17	3.02	0.0	4409.1
216	212	22	329	266.	13.17	2.85	0.0	483.0
211	213	328	330	594.	12.92	2.99	0.0	885.1
211	214	23	213	726.	12.92	3.03	0.0	1073.0
21	215	326	14	2729.	13.17	2.98	0.0	4634.9
21	216	333	215	3449.	13.08	2.99	0.0	5707.9
22	217	334	337	3655.	13.17	2.96	0.0	6391.8
29	218	341	20	4135.	13.17	2.91	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 10-AUG-9     Time: 13:35:19            |
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      INPUT FILE: input.50 ( PR )

      Rainfall RP =  50 yrs and P =  7.15 inches
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SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.82	680.9	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.66	362.7	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	3.53	348.7	13.58
24	319.4	13251.	8.93	70.1	204.	112.1	3.75	208.9	13.33
12	483.3	8556.	6.05	71.4	188.	92.6	3.89	347.5	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.74	1.2	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	3.30	226.5	13.25
5	251.2	6171.	6.64	70.3	181.	70.1	3.78	211.5	12.83
13	270.6	6497.	7.81	70.5	203.	67.0	3.80	252.0	12.83
2	275.2	7057.	9.52	69.9	182.	65.9	3.73	251.8	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	3.54	254.1	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.30	177.5	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	3.82	408.9	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	3.49	329.6	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.74	1.2	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.91	161.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.86	151.2	12.83
25	683.9	19564.	11.91	65.5	182.	149.7	3.27	284.1	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	3.17	640.6	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	681.	13.00	681.	13.00
81	79	2	1083.	2.03	6.	0.050	681.	13.00	680.	13.08
79	77	2	410.	1.95	6.	0.050	680.	13.08	680.	13.08
77	76	2	135.	7.41	10.	0.050	680.	13.08	680.	13.08
76	71	2	925.	1.84	10.	0.050	1043.	13.08	1043.	13.08
84	85	2	1366.	3.66	10.	0.050	349.	13.58	349.	13.58
85	74	2	374.	4.28	10.	0.050	349.	13.58	349.	13.58
74	72	2	576.	4.34	13.	0.050	349.	13.58	349.	13.58
72	71	2	541.	3.14	15.	0.050	349.	13.58	349.	13.67
71	7	2	10.	0.05	5.	0.050	1586.	13.17	1586.	13.17
110	1	2	103.	1.94	12.	0.050	347.	13.17	347.	13.17
1	3	2	1387.	1.30	12.	0.050	348.	13.17	347.	13.25
3	130	2	318.	3.46	6.	0.050	574.	13.25	574.	13.25
130	4	2	451.	2.44	6.	0.050	574.	13.25	574.	13.25
4	5	2	621.	1.13	15.	0.050	779.	13.08	779.	13.17
5	7	2	462.	2.60	15.	0.050	779.	13.17	779.	13.17
7	8	2	76.	0.01	20.	0.050	2606.	13.17	2604.	13.17
8	101	2	660.	0.45	20.	0.050	2604.	13.17	2604.	13.17
101	10	2	662.	1.06	20.	0.050	2604.	13.17	2604.	13.17
10	12	2	577.	1.39	20.	0.050	2604.	13.17	2603.	13.17
12	13	2	948.	1.16	5.	0.050	2840.	13.17	2840.	13.17
13	14	2	340.	0.01	5.	0.050	3053.	13.08	3052.	13.08
14	16	2	1832.	0.98	5.	0.050	3052.	13.08	3050.	13.08
16	17	2	246.	1.63	20.	0.050	3221.	13.08	3221.	13.08
17	19	2	857.	0.58	20.	0.050	3221.	13.08	3219.	13.08
19	21	2	427.	0.47	20.	0.050	3219.	13.08	3219.	13.17
214	212	2	1297.	3.39	20.	0.050	409.	12.75	408.	12.83
212	211	2	103.	10.00	20.	0.050	408.	12.83	408.	12.83
217	216	2	1545.	5.89	5.	0.050	330.	13.08	329.	13.08
216	211	2	965.	1.37	10.	0.050	330.	13.08	329.	13.17
211	223	2	118.	0.85	4.	0.050	892.	12.92	892.	12.92
223	218	2	757.	2.64	10.	0.050	892.	12.92	892.	12.92
218	21	2	712.	0.84	10.	0.050	892.	12.92	891.	13.00
21	22	2	223.	0.90	10.	0.050	4253.	13.08	4252.	13.08
222	225	2	639.	5.63	10.	0.050	284.	14.00	284.	14.00
225	220	2	67.	0.01	10.	0.050	284.	14.00	283.	14.00
220	22	2	1418.	3.10	5.	0.050	283.	14.00	283.	14.08
22	23	2	572.	1.40	10.	0.050	4507.	13.08	4506.	13.17
23	25	2	766.	1.57	10.	0.050	4506.	13.17	4506.	13.17
25	27	2	686.	1.17	10.	0.050	4506.	13.17	4505.	13.17
27	29	2	1616.	1.42	10.	0.050	4505.	13.17	4503.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	219	345	28	1043.	13.08	3.76	0.0	1338.8
71	220	346	350	1378.	13.17	3.68	0.0	1981.9
71	221	24	220	1586.	13.17	3.69	0.0	2301.3
1	222	7	352	348.	13.17	3.89	0.0	483.6
3	223	353	3	574.	13.25	3.64	0.0	852.4
4	224	5	355	779.	13.08	3.67	0.0	1103.6
7	225	13	351	1827.	13.17	3.71	0.0	2571.9
7	226	357	225	2606.	13.17	3.69	0.0	3675.5
12	227	361	2	2840.	13.17	3.70	0.0	3950.7
13	228	362	1	3053.	13.08	3.69	0.0	4185.7
16	229	10	364	3221.	13.08	3.67	0.0	4409.1
216	230	22	370	330.	13.08	3.49	0.0	483.0
211	231	369	371	731.	12.92	3.64	0.0	885.1
211	232	23	231	892.	12.92	3.69	0.0	1073.0
21	233	367	14	3365.	13.08	3.63	0.0	4634.9
21	234	374	233	4253.	13.08	3.64	0.0	5707.9
22	235	375	378	4507.	13.08	3.60	0.0	6391.8
29	236	382	20	5113.	13.17	3.55	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 10-AUG-9     Time: 13:36:57            |
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       INPUT FILE: input.100 (PR)

       Rainfall RP = 100 yrs and P =  7.80 inches
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SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	4.37	784.2	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	4.20	419.5	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	4.07	404.7	13.50
24	319.4	13251.	8.93	70.1	204.	112.1	4.30	241.0	13.33
12	483.3	8556.	6.05	71.4	188.	92.6	4.45	399.5	13.17
7	0.3	138.	2.39	70.0	180.	5.6	4.29	1.4	12.00
3	368.8	7933.	6.23	65.8	195.	99.8	3.82	264.6	13.17
5	251.2	6171.	6.64	70.3	181.	70.1	4.33	243.9	12.83
13	270.6	6497.	7.81	70.5	203.	67.0	4.35	290.4	12.75
2	275.2	7057.	9.52	69.9	182.	65.9	4.28	290.6	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	4.08	294.8	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.82	207.4	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	4.37	470.8	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	4.02	383.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	4.29	1.4	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	4.47	185.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	3.35	179.5	12.75
25	683.9	19564.	11.91	65.5	182.	149.7	3.79	331.9	14.00
20	838.8	6982.	13.91	64.5	184.	62.4	3.68	752.0	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA					PEAK FLOW DATA			
		CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	784.	13.00	784.	13.00
81	79	2	1083.	2.03	6.	0.050	784.	13.00	784.	13.00
79	77	2	410.	1.95	6.	0.050	784.	13.00	783.	13.00
77	76	2	135.	7.41	10.	0.050	783.	13.00	783.	13.08
76	71	2	925.	1.84	10.	0.050	1203.	13.08	1203.	13.08
84	85	2	1366.	3.66	10.	0.050	405.	13.50	405.	13.58
85	74	2	374.	4.28	10.	0.050	405.	13.58	405.	13.58
74	72	2	576.	4.34	13.	0.050	405.	13.58	405.	13.58
72	71	2	541.	3.14	15.	0.050	405.	13.58	404.	13.58
71	7	2	10.	0.05	5.	0.050	1832.	13.17	1832.	13.17
110	1	2	103.	1.94	12.	0.050	399.	13.17	399.	13.17
1	3	2	1387.	1.30	12.	0.050	400.	13.17	399.	13.17
3	130	2	318.	3.46	6.	0.050	664.	13.17	664.	13.17
130	4	2	451.	2.44	6.	0.050	664.	13.17	664.	13.25
4	5	2	621.	1.13	15.	0.050	901.	13.08	901.	13.08
5	7	2	462.	2.60	15.	0.050	901.	13.08	900.	13.17
7	8	2	76.	0.01	20.	0.050	3010.	13.08	3009.	13.08
8	101	2	660.	0.45	20.	0.050	3009.	13.08	3008.	13.17
101	10	2	662.	1.06	20.	0.050	3008.	13.17	3008.	13.17
10	12	2	577.	1.39	20.	0.050	3008.	13.17	3008.	13.17
12	13	2	948.	1.16	5.	0.050	3281.	13.08	3281.	13.17
13	14	2	340.	0.01	5.	0.050	3530.	13.08	3529.	13.08
14	16	2	1832.	0.98	5.	0.050	3529.	13.08	3528.	13.08
16	17	2	246.	1.63	20.	0.050	3728.	13.08	3728.	13.08
17	19	2	857.	0.58	20.	0.050	3728.	13.08	3726.	13.08
19	21	2	427.	0.47	20.	0.050	3726.	13.08	3725.	13.08
214	212	2	1297.	3.39	20.	0.050	471.	12.75	470.	12.75
212	211	2	103.	10.00	20.	0.050	470.	12.75	470.	12.75
217	216	2	1545.	5.89	5.	0.050	383.	13.08	383.	13.08
216	211	2	965.	1.37	10.	0.050	383.	13.08	383.	13.17
211	223	2	118.	0.85	4.	0.050	1031.	12.92	1030.	12.92
223	218	2	757.	2.64	10.	0.050	1030.	12.92	1030.	12.92
218	21	2	712.	0.84	10.	0.050	1030.	12.92	1029.	12.92
21	22	2	223.	0.90	10.	0.050	4924.	13.08	4924.	13.08
222	225	2	639.	5.63	10.	0.050	332.	14.00	332.	14.00
225	220	2	67.	0.01	10.	0.050	332.	14.00	331.	14.00
220	22	2	1418.	3.10	5.	0.050	331.	14.00	331.	14.00
22	23	2	572.	1.40	10.	0.050	5224.	13.08	5222.	13.08
23	25	2	766.	1.57	10.	0.050	5222.	13.08	5220.	13.08
25	27	2	686.	1.17	10.	0.050	5220.	13.08	5218.	13.17
27	29	2	1616.	1.42	10.	0.050	5218.	13.17	5218.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	201	304	28	1203.	13.08	4.31	0.0	1338.8
71	202	305	309	1593.	13.17	4.23	0.0	1981.9
71	203	24	202	1832.	13.17	4.24	0.0	2301.3
1	204	7	311	400.	13.17	4.45	0.0	483.6
3	205	312	3	664.	13.17	4.18	0.0	852.4
4	206	5	314	901.	13.08	4.21	0.0	1103.6
7	207	13	310	2110.	13.08	4.25	0.0	2571.9
7	208	316	207	3010.	13.08	4.24	0.0	3675.5
12	209	320	2	3281.	13.08	4.24	0.0	3950.7
13	210	321	1	3530.	13.08	4.23	0.0	4185.7
16	211	10	323	3728.	13.08	4.21	0.0	4409.1
216	212	22	329	383.	13.08	4.02	0.0	483.0
211	213	328	330	845.	12.92	4.18	0.0	885.1
211	214	23	213	1031.	12.92	4.23	0.0	1073.0
21	215	326	14	3899.	13.08	4.17	0.0	4634.9
21	216	333	215	4924.	13.08	4.18	0.0	5707.9
22	217	334	337	5224.	13.08	4.14	0.0	6391.8
29	218	341	20	5935.	13.08	4.09	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 11-AUG-9     Time: 16:41:18            |
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INPUT FILE: INPUT.25 (FUTURE)

Rainfall RP = 25 yrs and P = 6.35 inches

SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.15	556.8	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.01	294.8	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	2.89	282.1	13.58
24	319.4	13251.	8.93	70.2	204.	111.8	3.10	171.1	13.42
12	483.3	8556.	6.05	71.5	187.	92.4	3.23	284.6	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.09	1.0	12.00
3	368.8	7933.	6.23	66.4	204.	98.2	2.74	192.8	13.25
5	251.2	6171.	6.64	70.6	185.	69.6	3.14	177.8	12.83
13	270.6	6497.	7.81	70.9	204.	66.3	3.17	229.6	12.67
2	275.2	7057.	9.52	69.9	182.	65.9	3.08	205.3	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	2.90	205.5	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	2.68	141.9	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	3.15	334.5	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	2.85	266.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.09	1.0	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.24	132.7	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.29	118.2	12.83
25	683.9	19564.	11.91	66.2	189.	147.0	2.72	242.0	14.00
20	838.8	6982.	13.91	64.5	183.	62.4	2.56	506.3	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA: CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA: INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	557.	13.00	557.	13.08
81	79	2	1083.	2.03	6.	0.050	557.	13.08	557.	13.08
79	77	2	410.	1.95	6.	0.050	557.	13.08	557.	13.08
77	76	2	135.	7.41	10.	0.050	557.	13.08	557.	13.08
76	71	2	925.	1.84	10.	0.050	851.	13.08	851.	13.08
84	85	2	1366.	3.66	10.	0.050	282.	13.58	282.	13.67
85	74	2	374.	4.28	10.	0.050	282.	13.67	282.	13.67
74	72	2	576.	4.34	13.	0.050	282.	13.67	282.	13.67
72	71	2	541.	3.14	15.	0.050	282.	13.67	282.	13.67
71	7	2	10.	0.05	5.	0.050	1292.	13.25	1292.	13.25
110	1	2	103.	1.94	12.	0.050	285.	13.17	285.	13.17
1	3	2	1387.	1.30	12.	0.050	285.	13.17	285.	13.25
3	130	2	318.	3.46	6.	0.050	477.	13.25	477.	13.25
130	4	2	451.	2.44	6.	0.050	477.	13.25	477.	13.25
4	5	2	621.	1.13	15.	0.050	650.	13.17	650.	13.17
5	7	2	462.	2.60	15.	0.050	650.	13.17	650.	13.17
7	8	2	76.	0.01	20.	0.050	2152.	13.17	2151.	13.17
8	101	2	660.	0.45	20.	0.050	2151.	13.17	2150.	13.17
101	10	2	662.	1.06	20.	0.050	2150.	13.17	2150.	13.17
10	12	2	577.	1.39	20.	0.050	2150.	13.17	2149.	13.17
12	13	2	948.	1.16	5.	0.050	2344.	13.17	2343.	13.17
13	14	2	340.	0.01	5.	0.050	2517.	13.08	2514.	13.08
14	16	2	1832.	0.98	5.	0.050	2514.	13.08	2513.	13.17
16	17	2	246.	1.63	20.	0.050	2650.	13.08	2649.	13.08
17	19	2	857.	0.58	20.	0.050	2649.	13.08	2649.	13.17
19	21	2	427.	0.47	20.	0.050	2649.	13.17	2649.	13.17
214	212	2	1297.	3.39	20.	0.050	335.	12.75	334.	12.83
212	211	2	103.	10.00	20.	0.050	334.	12.83	334.	12.83
217	216	2	1545.	5.89	5.	0.050	266.	13.08	266.	13.17
216	211	2	965.	1.37	10.	0.050	266.	13.17	266.	13.17
211	223	2	118.	0.85	4.	0.050	726.	12.92	726.	12.92
223	218	2	757.	2.64	10.	0.050	726.	12.92	726.	13.00
218	21	2	712.	0.84	10.	0.050	726.	13.00	726.	13.00
21	22	2	223.	0.90	10.	0.050	3485.	13.08	3485.	13.08
222	225	2	639.	5.63	10.	0.050	242.	14.00	242.	14.00
225	220	2	67.	0.01	10.	0.050	242.	14.00	241.	14.00
220	22	2	1418.	3.10	5.	0.050	241.	14.00	241.	14.08
22	23	2	572.	1.40	10.	0.050	3703.	13.17	3703.	13.17
23	25	2	766.	1.57	10.	0.050	3703.	13.17	3702.	13.17
25	27	2	686.	1.17	10.	0.050	3702.	13.17	3701.	13.17
27	29	2	1616.	1.42	10.	0.050	3701.	13.17	3698.	13.25

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	201	304	28	851.	13.08	3.10	0.0	1338.8
71	202	305	309	1122.	13.25	3.03	0.0	1981.9
71	203	24	202	1292.	13.25	3.04	0.0	2301.3
1	204	7	311	285.	13.17	3.23	0.0	483.6
3	205	312	3	477.	13.25	3.02	0.0	852.4
4	206	5	314	650.	13.17	3.05	0.0	1103.6
7	207	13	310	1503.	13.17	3.06	0.0	2571.9
7	208	316	207	2152.	13.17	3.05	0.0	3675.5
12	209	320	2	2344.	13.17	3.06	0.0	3950.7
13	210	321	1	2517.	13.08	3.05	0.0	4185.7
16	211	10	323	2650.	13.08	3.03	0.0	4409.1
216	212	22	329	266.	13.17	2.85	0.0	483.0
211	213	328	330	594.	12.92	2.99	0.0	885.1
211	214	23	213	726.	12.92	3.03	0.0	1073.0
21	215	326	14	2763.	13.17	2.99	0.0	4634.9
21	216	333	215	3485.	13.08	3.00	0.0	5707.9
22	217	334	337	3703.	13.17	2.97	0.0	6391.8
29	218	341	20	4183.	13.17	2.92	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 11-AUG-9     Time: 16:41:37            |
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INPUT FILE: INPUT.50 (FUTURE)

Rainfall RP = 50 yrs and P = 7.15 inches

SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	3.82	680.9	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	3.66	362.7	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	3.53	348.7	13.58
24	319.4	13251.	8.93	70.2	204.	111.8	3.76	209.6	13.33
12	483.3	8556.	6.05	71.5	187.	92.4	3.90	346.9	13.17
7	0.3	138.	2.39	70.0	180.	5.6	3.74	1.2	12.00
3	368.8	7933.	6.23	66.4	204.	98.2	3.36	240.2	13.17
5	251.2	6171.	6.64	70.6	185.	69.6	3.81	217.6	12.83
13	270.6	6497.	7.81	70.9	204.	66.3	3.84	280.5	12.67
2	275.2	7057.	9.52	69.9	182.	65.9	3.73	251.8	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	3.54	254.1	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.30	177.5	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	3.82	408.9	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	3.49	329.6	13.08
22	0.3	138.	20.13	70.0	180.	1.9	3.74	1.2	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	3.91	161.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	2.86	151.2	12.83
25	683.9	19564.	11.91	66.2	189.	147.0	3.34	301.2	13.92
20	838.8	6982.	13.91	64.5	183.	62.4	3.17	637.6	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA INFLOW (CFS)	(HR)	OUTFLOW (CFS)	(HR)
83	81	2	413.	7.02	6.	0.050	681.	13.00	681.	13.00
81	79	2	1083.	2.03	6.	0.050	681.	13.00	680.	13.08
79	77	2	410.	1.95	6.	0.050	680.	13.08	680.	13.08
77	76	2	135.	7.41	10.	0.050	680.	13.08	680.	13.08
76	71	2	925.	1.84	10.	0.050	1043.	13.08	1043.	13.08
84	85	2	1366.	3.66	10.	0.050	349.	13.58	349.	13.58
85	74	2	374.	4.28	10.	0.050	349.	13.58	349.	13.58
74	72	2	576.	4.34	13.	0.050	349.	13.58	349.	13.58
72	71	2	541.	3.14	15.	0.050	349.	13.58	349.	13.67
71	7	2	10.	0.05	5.	0.050	1586.	13.17	1586.	13.17
110	1	2	103.	1.94	12.	0.050	347.	13.17	347.	13.17
1	3	2	1387.	1.30	12.	0.050	347.	13.17	347.	13.25
3	130	2	318.	3.46	6.	0.050	587.	13.17	587.	13.25
130	4	2	451.	2.44	6.	0.050	587.	13.25	587.	13.25
4	5	2	621.	1.13	15.	0.050	798.	13.08	798.	13.08
5	7	2	462.	2.60	15.	0.050	798.	13.08	798.	13.17
7	8	2	76.	0.01	20.	0.050	2642.	13.08	2641.	13.08
8	101	2	660.	0.45	20.	0.050	2641.	13.08	2640.	13.17
101	10	2	662.	1.06	20.	0.050	2640.	13.17	2639.	13.17
10	12	2	577.	1.39	20.	0.050	2639.	13.17	2639.	13.17
12	13	2	948.	1.16	5.	0.050	2877.	13.08	2877.	13.17
13	14	2	340.	0.01	5.	0.050	3093.	13.08	3092.	13.08
14	16	2	1832.	0.98	5.	0.050	3092.	13.08	3091.	13.08
16	17	2	246.	1.63	20.	0.050	3262.	13.08	3262.	13.08
17	19	2	857.	0.58	20.	0.050	3262.	13.08	3260.	13.08
19	21	2	427.	0.47	20.	0.050	3260.	13.08	3259.	13.08
214	212	2	1297.	3.39	20.	0.050	409.	12.75	408.	12.83
212	211	2	103.	10.00	20.	0.050	408.	12.83	408.	12.83
217	216	2	1545.	5.89	5.	0.050	330.	13.08	329.	13.08
216	211	2	965.	1.37	10.	0.050	330.	13.08	329.	13.17
211	223	2	118.	0.85	4.	0.050	892.	12.92	892.	12.92
223	218	2	757.	2.64	10.	0.050	892.	12.92	892.	12.92
218	21	2	712.	0.84	10.	0.050	892.	12.92	891.	13.00
21	22	2	223.	0.90	10.	0.050	4295.	13.08	4294.	13.08
222	225	2	639.	5.63	10.	0.050	301.	13.92	301.	14.00
225	220	2	67.	0.01	10.	0.050	301.	14.00	300.	14.00
220	22	2	1418.	3.10	5.	0.050	300.	14.00	300.	14.00
22	23	2	572.	1.40	10.	0.050	4565.	13.08	4564.	13.08
23	25	2	766.	1.57	10.	0.050	4564.	13.08	4562.	13.17
25	27	2	686.	1.17	10.	0.050	4562.	13.17	4562.	13.17
27	29	2	1616.	1.42	10.	0.050	4562.	13.17	4561.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	219	345	28	1043.	13.08	3.76	0.0	1338.8
71	220	346	350	1378.	13.17	3.68	0.0	1981.9
71	221	24	220	1586.	13.17	3.70	0.0	2301.3
1	222	7	352	347.	13.17	3.90	0.0	483.6
3	223	353	3	587.	13.17	3.67	0.0	852.4
4	224	5	355	798.	13.08	3.70	0.0	1103.6
7	225	13	351	1845.	13.08	3.71	0.0	2571.9
7	226	357	225	2642.	13.08	3.71	0.0	3675.5
12	227	361	2	2877.	13.08	3.71	0.0	3950.7
13	228	362	1	3093.	13.08	3.70	0.0	4185.7
16	229	10	364	3262.	13.08	3.68	0.0	4409.1
216	230	22	370	330.	13.08	3.49	0.0	483.0
211	231	369	371	731.	12.92	3.64	0.0	885.1
211	232	23	231	892.	12.92	3.69	0.0	1073.0
21	233	367	14	3407.	13.08	3.64	0.0	4634.9
21	234	374	233	4295.	13.08	3.65	0.0	5707.9
22	235	375	378	4565.	13.08	3.62	0.0	6391.8
29	236	382	20	5168.	13.08	3.56	0.0	7230.6

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|   DRAIN:HYDRO, Version 1.0, February, 1996     |
|   University of South Carolina                 |
|   Dept of Civil and Environmental Engineering  |
|   Date: 11-AUG-9     Time: 16:33:57            |
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INPUT FILE: input.100 (FUTURE)

Rainfall RP = 100 yrs and P = 7.80 inches

SUMMARY OUTPUT

***** RUNOFF HYDROGRAPH DATA *****

	WATERSHED DATA				UH PEAK ORD		HYDROGRAPH DATA		
WS NO	AREA (AC)	LENGTH (FT)	SLOPE (%)	CURVE NO	PRF (CSM)	TC (MIN)	VOLUME (IN)	PEAK (CFS)	PEAK TIME (HRS)
27	835.6	9974.	8.44	70.7	207.	90.4	4.37	784.2	13.00
28	503.2	9734.	9.02	69.2	189.	89.3	4.20	419.5	13.08
21	643.1	11890.	7.59	68.0	189.	117.9	4.07	404.7	13.50
24	319.4	13251.	8.93	70.2	204.	111.8	4.32	241.7	13.33
12	483.3	8556.	6.05	71.5	187.	92.4	4.46	398.8	13.17
7	0.3	138.	2.39	70.0	180.	5.6	4.29	1.4	12.00
3	368.8	7933.	6.23	66.4	204.	98.2	3.89	280.1	13.17
5	251.2	6171.	6.64	70.6	185.	69.6	4.36	250.6	12.83
13	270.6	6497.	7.81	70.9	204.	66.3	4.39	322.9	12.67
2	275.2	7057.	9.52	69.9	182.	65.9	4.28	290.6	12.75
1	235.0	4547.	9.55	68.1	183.	48.6	4.08	294.8	12.50
10	223.4	5213.	8.60	65.8	182.	60.7	3.82	207.4	12.75
19	402.1	7671.	9.72	70.7	226.	68.2	4.37	470.8	12.75
26	482.7	9301.	10.05	67.6	189.	85.1	4.02	383.0	13.08
22	0.3	138.	20.13	70.0	180.	1.9	4.29	1.4	12.00
23	187.9	13694.	13.13	71.6	214.	91.1	4.47	185.6	13.00
14	225.8	5476.	10.17	61.5	182.	64.8	3.35	179.5	12.75
25	683.9	19564.	11.91	66.2	189.	147.0	3.87	351.3	13.92
20	838.8	6982.	13.91	64.5	183.	62.4	3.68	748.5	12.75

***** ROUTING DATA *****

CONDUIT CODE = 1 - PIPE
= 2 - DITCH
= 3 - STREAM

CONNECTING NODE NOS		CONDUIT DATA: CODE NO	LENGTH (FT)	SLOPE (%)	DIA-WIDTH (IN-FT)	MANNING N-VALUE	PEAK FLOW DATA: INFLOW (CFS)	INFLOW (HR)	OUTFLOW (CFS)	OUTFLOW (HR)
83	81	2	413.	7.02	6.	0.050	784.	13.00	784.	13.00
81	79	2	1083.	2.03	6.	0.050	784.	13.00	784.	13.00
79	77	2	410.	1.95	6.	0.050	784.	13.00	783.	13.00
77	76	2	135.	7.41	10.	0.050	783.	13.00	783.	13.08
76	71	2	925.	1.84	10.	0.050	1203.	13.08	1203.	13.08
84	85	2	1366.	3.66	10.	0.050	405.	13.50	405.	13.58
85	74	2	374.	4.28	10.	0.050	405.	13.58	405.	13.58
74	72	2	576.	4.34	13.	0.050	405.	13.58	405.	13.58
72	71	2	541.	3.14	15.	0.050	405.	13.58	404.	13.58
71	7	2	10.	0.05	5.	0.050	1833.	13.17	1833.	13.17
110	1	2	103.	1.94	12.	0.050	399.	13.17	399.	13.17
1	3	2	1387.	1.30	12.	0.050	399.	13.17	399.	13.17
3	130	2	318.	3.46	6.	0.050	679.	13.17	679.	13.17
130	4	2	451.	2.44	6.	0.050	679.	13.17	678.	13.17
4	5	2	621.	1.13	15.	0.050	922.	13.08	922.	13.08
5	7	2	462.	2.60	15.	0.050	922.	13.08	922.	13.08
7	8	2	76.	0.01	20.	0.050	3052.	13.08	3051.	13.08
8	101	2	660.	0.45	20.	0.050	3051.	13.08	3050.	13.08
101	10	2	662.	1.06	20.	0.050	3050.	13.08	3048.	13.08
10	12	2	577.	1.39	20.	0.050	3048.	13.08	3048.	13.17
12	13	2	948.	1.16	5.	0.050	3325.	13.08	3324.	13.08
13	14	2	340.	0.01	5.	0.050	3574.	13.08	3573.	13.08
14	16	2	1832.	0.98	5.	0.050	3573.	13.08	3573.	13.08
16	17	2	246.	1.63	20.	0.050	3773.	13.08	3773.	13.08
17	19	2	857.	0.58	20.	0.050	3773.	13.08	3772.	13.08
19	21	2	427.	0.47	20.	0.050	3772.	13.08	3771.	13.08
214	212	2	1297.	3.39	20.	0.050	471.	12.75	470.	12.75
212	211	2	103.	10.00	20.	0.050	470.	12.75	470.	12.75
217	216	2	1545.	5.89	5.	0.050	383.	13.08	383.	13.08
216	211	2	965.	1.37	10.	0.050	383.	13.08	383.	13.17
211	223	2	118.	0.85	4.	0.050	1031.	12.92	1030.	12.92
223	218	2	757.	2.64	10.	0.050	1030.	12.92	1030.	12.92
218	21	2	712.	0.84	10.	0.050	1030.	12.92	1029.	12.92
21	22	2	223.	0.90	10.	0.050	4970.	13.08	4970.	13.08
222	225	2	639.	5.63	10.	0.050	351.	13.92	351.	13.92
225	220	2	67.	0.01	10.	0.050	351.	13.92	350.	13.92
220	22	2	1418.	3.10	5.	0.050	350.	13.92	350.	14.00
22	23	2	572.	1.40	10.	0.050	5288.	13.08	5287.	13.08
23	25	2	766.	1.57	10.	0.050	5287.	13.08	5286.	13.08
25	27	2	686.	1.17	10.	0.050	5286.	13.08	5283.	13.08
27	29	2	1616.	1.42	10.	0.050	5283.	13.08	5282.	13.17

***** ADDED HYDROGRAPHS DATA *****

NODE NO	HYD NO	ADDED HYD NOS 1st	2nd	SUMMATION HYDROGRAPH PEAK (CFS)	PEAK TIME (HRS)	HYD VOLUME (INCHES)	BASEFLOW (CFS)	DRAINAGE AREA (ACRES)
76	237	386	28	1203.	13.08	4.31	0.0	1338.8
71	238	387	391	1593.	13.17	4.23	0.0	1981.9
71	239	24	238	1833.	13.17	4.24	0.0	2301.3
1	240	7	393	399.	13.17	4.46	0.0	483.6
3	241	394	3	679.	13.17	4.21	0.0	852.4
4	242	5	396	922.	13.08	4.25	0.0	1103.6
7	243	13	392	2131.	13.08	4.26	0.0	2571.9
7	244	398	243	3052.	13.08	4.26	0.0	3675.5
12	245	402	2	3325.	13.08	4.26	0.0	3950.7
13	246	403	1	3574.	13.08	4.25	0.0	4185.7
16	247	10	405	3773.	13.08	4.23	0.0	4409.1
216	248	22	411	383.	13.08	4.02	0.0	483.0
211	249	410	412	845.	12.92	4.18	0.0	885.1
211	250	23	249	1031.	12.92	4.23	0.0	1073.0
21	251	408	14	3946.	13.08	4.18	0.0	4634.9
21	252	415	251	4970.	13.08	4.19	0.0	5707.9
22	253	416	419	5288.	13.08	4.16	0.0	6391.8
29	254	423	20	5999.	13.08	4.10	0.0	7230.6

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